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Steam Engine Tools and Gages Used by Struthers & Wells Iron Works.

BY JOHN RANDOL.

The Struthers & Wells Iron Works, located at Warren, Pa., has been in business for a long time, having been started as a foundry in 1851. The concern now employs about 300 hands, and makes engines, boilers and general machine work, and has an especially fine foundry. A great deal of original work has been done in these shops, which are comparatively isolated, and have always been the best of their kind for many miles in any direction.

Warren is located on the northeastern extreme of the oil fields of Pennsylvania, and for many years built enormous numbers of small horizontal link motion, winding engines, 8, 9, 10 and 12 inches bore by 12 inches stroke.

This establishment adopted at the outset the style of engine bed shown on the planer in Fig. 1, in which the cylinder is overhung at the rear, while the crank shaft has double bearings at the front end.

The gage points of the planed work on these beds, which, of course, follows the lathe work, are the location of the guides and pillow block facing correctly with the piston rod hole and stuffing box seat in the cylinder end of the frame.

Planer hands very well know the care and time it takes to properly locate planed surfaces with relation to previously finished lathe work, and the very simple and cheaply constructed gages, by use of which the planer tool setting is made at once easy and accurate in these shops immediately attracted my attention. These gages were designed by Mr. H. E. Davis, who is now foreman of Struthers & Wells' machine department, but who was a planer hand in these shops long enough to plane more than 9,000 of these engine beds, most of them with the aid of the gages shown.

Before these gages were made there was always some trouble with the erecting, due to faulty location of the planed surfaces on the beds with relation to the lathe work, although Mr. Davis says he used great care and always believed his work was right.

The cylinder seat *S*, Fig. 1, is turned in the lathe on centers, the center at the crank end of the bed being formed in a substantial lug cast on the bed for that purpose, shown in Fig. 2, in which this lug is marked *L*.

After the cylinder seat is finished the steady rest is applied, the tailstock pulled back and the piston rod hole *H*, Fig 1, is drilled, bored and reamed to size. Then a back poring cutter spindle exactly fitting the piston rod hole is placed in the tailstock spindle and shoved through the piston rod hole until the cutter mortise in the front end of this cutter spindle shows clear in front of the stuffing box boss; then the gland seat cutter is slipped into the cutter spindle and fastened with a set screw in the end of the spindle and the follower seat is formed by back boring with a tail spindle feed. As will be noticed later there is an opportunity for error in this operation, and, as a matter of course, where the opportunity for error exists the error is sure to appear in the work sometimes. The stuffing box boss is not always exactly central with the bored piston rod hole *H*. Hence the back boring cutter which forms the follower seat may work in metal harder on one side than on the other, and as the only guide for this cutter is the running fit of the spindle in the piston rod hole *H*, it is very clear that the counterboring which forms the follower seat may not always be exactly concentric with the piston rod hole. This could be helped by taking a fine boring tool cut in the counterbore and then reaming the follower seat to size. The follower seat should be exactly concentric with the other lathe work because, as will be seen, it is this follower seat, and not the piston rod hole *H*, which is

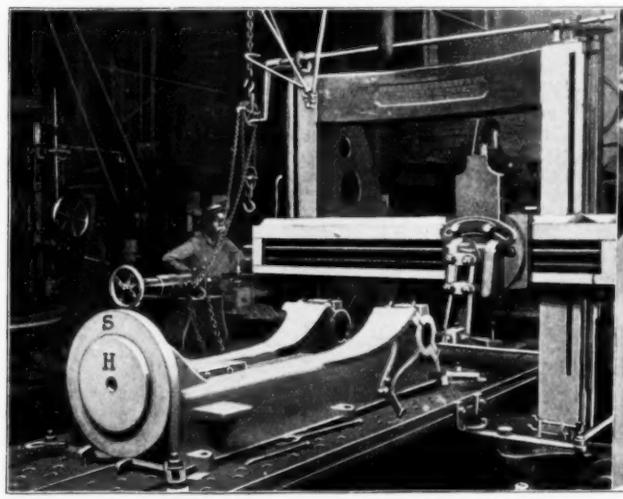

FIG. 1.—STRUTHERS & WELLS ENGINE BED ON THE PLANER. SIDING DOWN THE FACE OF THE PILLOW BLOCK

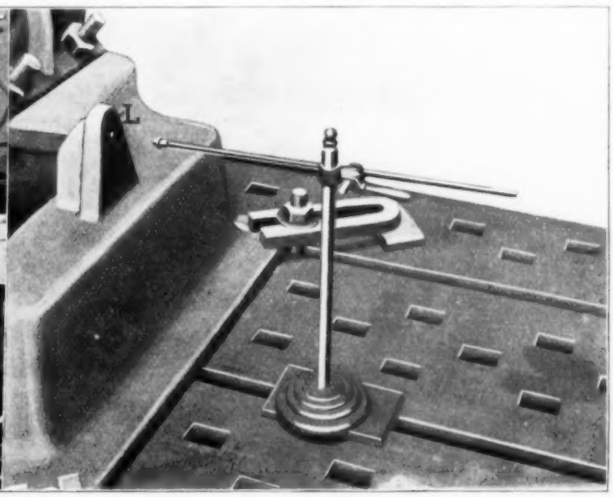

FIG. 2.—SURFACE GAGE WITH TONGUED BASE FITTING PLANER TABLE SLOT.

made the gage surface in setting the bed on the planer, because the piston rod hole *H* has but very little length after the follower seat counterboring is completed.

It would be better to send the beds to the planer as soon as the piston rod hole was reamed, as there is then a long, true gage seat in the bed. But this course would make an expensive extra handling, and the suggested boring of the follower seat with a boring tool and then reaming to standard size would also make more work, and it is almost needless to say that the costs of these engines must be kept at the very lowest possible figure. The planer hand now planing these beds seemed inclined to think the hole could be used to better advantage. Mr. Davis however, did not appear to think this point of much importance, and as he has planed more than 9,000 of the beds himself his opinion carries weight.

The beds are strapped to the planer table, as clearly shown in Figs. 1 and 2, the surface gage with a tongued foot, shown in Fig. 2, being used to set the bed exactly true with the lathe work centers. To do this the short plug *P*, shown in Fig. 3, is slipped into the stuffing box seat, which it fits closely, and the tongued base surface gage is then applied to the forward center in the plug *P*. Then the surface gage is taken to the front end of the bed, as shown in Fig. 2, without moving the index, and as the tongue on the base of the surface gage fits the middle groove of the planer table without shake, it is thus made an easy matter to set the engine bed so that the planing will be exactly at right angles to the lathe work, provided that the gland counterbore is exactly concentric with the piston rod hole *H*, as before specified. The ordinary round base of the surface gage is secured rigidly to the rectangular tongued shoe, and I do not know why it appears to be such a one-sided construction.

The first planer cut surfaces the top of the crosshead guides. The tool is set for the hight of this guide surface by means of the reduced size *A* on the plug *P*, Fig. 3. When this plug is in place in the gland seat, the under side of this small diameter part *A* is in the plane of the top of the guides; to transfer this measurement to the cutting tool the transfer plug gage *B*, Fig. 3, is used.

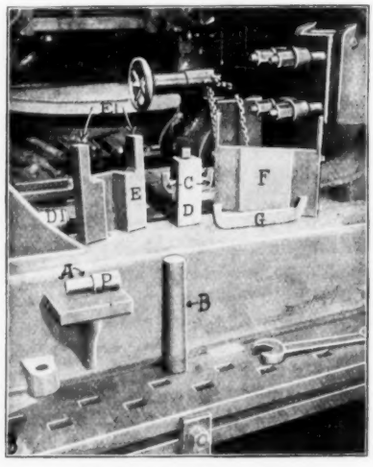

FIG. 3.—ENGINE BED GAGES AND PLANING TOOLS.

This plug *B* is supposed to exactly fill standing endwise between the under side of *A* and the top of the planer table. As the engine bed is rough on the bottom I do not see how this gage *B* can always fill exactly. Mr. Davis explained that this hight gage *B* was papered up under the foot when slack. Why it is not made adjustable I did not ask. Nothing in the way of an adjustment could be more reliable, perhaps, than papering the bottom, or cheaper, or used with less loss of time.

Having surfaced the top of the guides, they are next faced down inside with the double-ended tool *C*, Figs 3, 4 and 5, which is set by means of the two-horned gage *E*, Figs. 3 and 5. This gage *E* is formed as shown in Fig. 3, with a large square groove lengthwise of its middle part, and two projecting gage horns located exactly the same distance from the sides of the square groove. To use this gage *E* the long plug *D*1 is slipped into the follower seat, as shown in Fig. 4; then the square groove in *E*, which is of a width exactly the same as the diameter of the long plug *D*1 is slipped over *D*1, and the horns of the gage *E*1 are then correctly located for setting the double-end tool *C* for siding down the inside of the crosshead guides, as shown in Fig. 5. It will also be observed in Fig. 5 that the square groove in *E* is planed to such a depth as to make the under side of *E* exactly touch the top of guides when the bottom of the square groove in *E* rests on top of the long plug *D*1. Thus the work is gaged as it goes. Of course it is not pretended that this gaging, performed by the simple and comparatively rough and etremely cheap gages shown, is within an extremely small limit. It is, however, abundantly close for the class of work which it is desired to produce, and anything closer would be a mistake, as the tools would cost more in first cost, in time to use and in up-keep.

In such a case as this "good enough" is not only "as good as better," but is far better than useless minuteness of measurement, not demanded by the product, and adding very materially to the cost of every step of production.

The next point is to bring the inside ends of the crank-shaft pillow blocks the

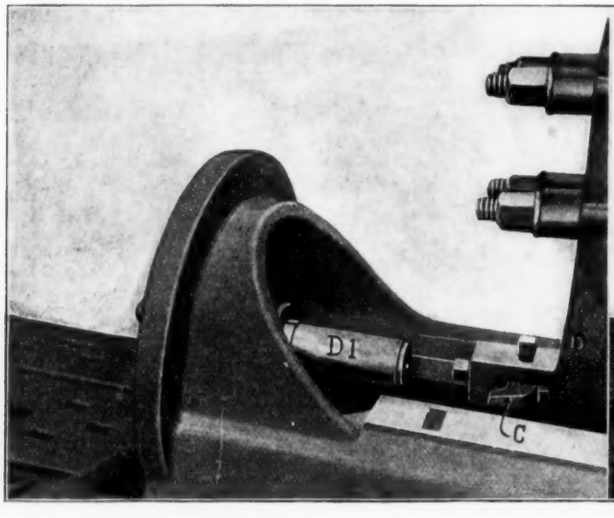

FIG. 4.—READY TO APPLY GAGE E.

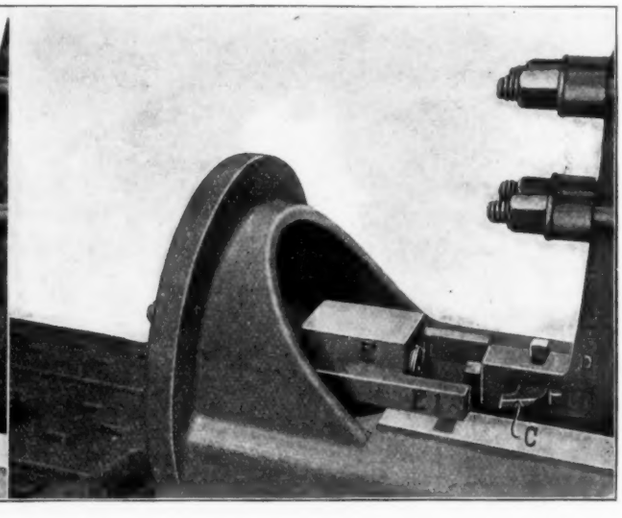

FIG. 5.—READY TO SET TOOL C SIDEWISE.

right distance apart, and have that distance evenly divided from the center line of the engine bed. For this purpose the two-horned gage *F*, Fig. 3, is used. This gage has a wide tongue to fit between the guides, and two gage horns, bolted to the sides of the gage body, which is planed to the width required between the pillow blocks. The actual planing of this cut is effected by the double-ended cutter *G*, seen in front of *F*, Fig. 3. This cutter goes in the same cutter stock used for siding down the inside of the guides.

Of course it is needful that the crosshead should be correctly machined. This is effected by milling on an Ingersoll milling machine, as shown in Fig. 6.

The fixture is a very simple and substantial structure, consisting of two V-shaped uprights, rising from a heavy base plate, and provided with horizontal brackets to support the clamp ends.

The crossheads are threaded and screwed on the piston rods, which makes them easy to secure to the short rod used in the milling fixture. The crosshead is not indexed 180 degrees, but is simply supported on a double wedge, adjustable hight parallel, as shown in Fig. 7. This is made of cast iron, planed all over to dimensions given, and is not fastened to the milling machine table in any way. It is simply slipped up to fit under the crosshead for the first cut, and the same for the second cut on the other side, the top wedge being secured by the set screw when the contact is felt.

The feed used in milling is very fine, as shown by the chips, and the machine turns off ten completely surfaced crossheads per day.

The shop economist need shed no tears over this fine milling feed, however, as the youth who attends the milling machine also keeps a large upright drilling machine, with an automatic feed, at work. The labor cost for finishing those crossheads is a good deal under $10 apiece. I doubt if it reaches 1 per cent. of that sum, and think tool making might be included and still leave a profit on the flat cost at 10 cents a crosshead for milling both sides.

Fig. 8 shows the crank-shaft wrist turning fixtures used in the lathe, and is given because it furnishes a thoroughly good example of sound construction. As will be seen, the center lugs are not split at the hub, but have solid eyes, and are secured to the shaft ends by two substantial set screws in each. The hub is sloped up at an angle on each side, and two drivers are employed, of necessity, on the face plate. The balance weight is a single segmental slab, held by two bolts at the outer circumference of the face plate, all shipshape and Bristol fashion.

Fig. 9 shows another lathe fixture, used for boring the rod brasses, which are finished one side, round, collar and all, and then turned over to a mid-cross line on the fixture for finishing the round and collar on the other side. This is also a very simple and cheap fixture. The set screws in the lugs at each end and the side ledges of the fixture hold the strap and brasses laterally, and a thin strap applied on each side holds the job snug up against the fixture.

It is a very common thing to finish rod brasses by first boring them on loose parallels on the face plate, and then keying them on an arbor to finish the collars and flats, with an expenditure of twice or three times the labor used with this very simple fixture, which is applied to a special face plate, and so is always ready to run on to the nose of the lathe spindle and go to work.

It is always most instructive to examine the tools and fixtures used in shops where standard lines of production are made in large quantities, and I am sure the thanks of the readers of this journal are due to the superintendent of the Struthers & Wells Iron Works, Mr. Van Doorn, who cordially gave me the freedom of his extremely well conducted shops for use in print.

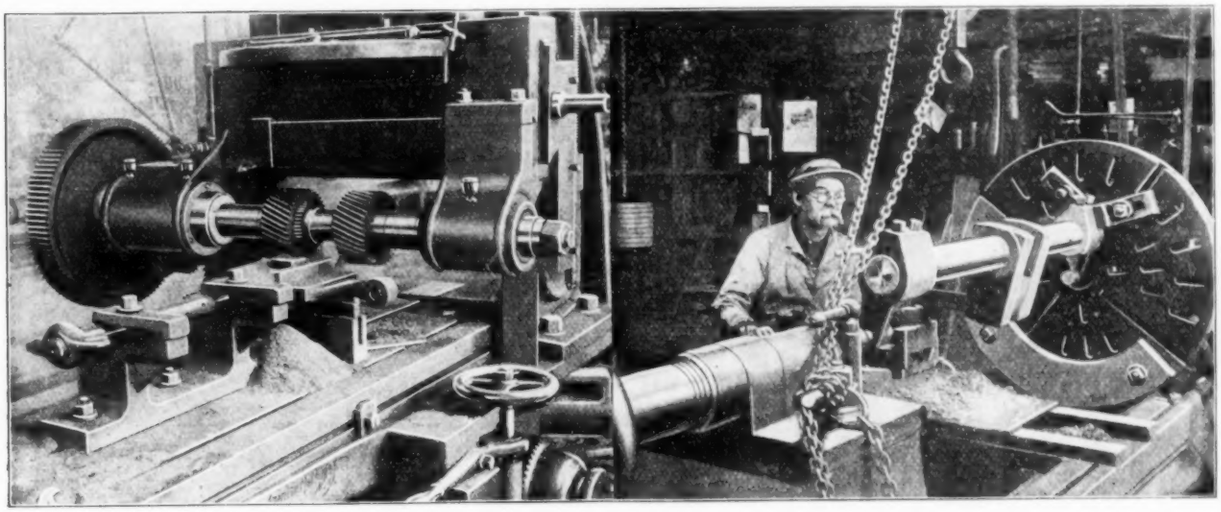

FIG. 6.—MILLING THE CROSSHEAD.

FIG. 8.—CRANK-PIN TURNING APPLIANCES.

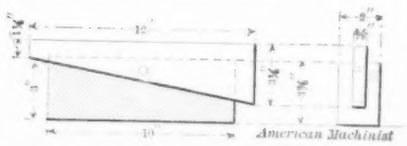

FIG. 7.—DOUBLE WEDGE ADJUSTABLE PARALLEL BLOCK.

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The Cleveland Oil Business.

The latest name for the Cleveland gentry who are so sadly unfortunate with small shipments of lubricating oil, and will sell a small consignment "near your place" at a reduced rate to save further expense, is the Sibley Oil & Grease Manufacturing Company. At the same time, the older "companies," yclept the Valley Oil Company, Prospect Oil Company, Superior Oil Company, Tiona Oil Company, Reliance Oil & Grease Com-

FIG. 9.—FIXTURE FOR CONNECTING ROD BRASSES.

pany, Lake Side Oil Company, Planet Oil Company, Eastman Oil Works and others, continue as of yore to ship too late, to allow their shipping clerks to make mistakes in shipping, to ship to irresponsible parties whom they do not investigate until after the oil is shipped, and so on without end. In some cases our friends toy with them for a while and then send us the whole correspondence, and we now have quite an interesting collection, showing how phenomenally careless these oil companies are in making shipments.

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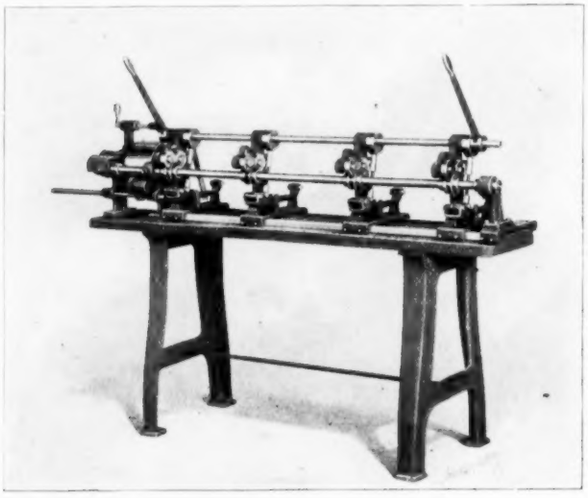
Multiple Tube Cutter and Automatic Bicycle Hub Drilling Machine.

The accompanying half-tones well illustrate the extent to which the specialization of tools for the manufacture of bicycles has been carried. The first shows a multiple tool cutter and the second an automatic drill for the flanges of the wheel hubs.

The main shaft of the tube cutter will be seen to carry several cutting disks which are adjustable to any point of its length as the shaft is splined from end to end. The sleeves on which the cutting disks are mounted are grooved, as will be seen, and in these grooves anti-friction rollers run and serve at once to take the pressure of the cut and to retain the disks in position on the shaft.



MULTIPLE TUBE CUTTER

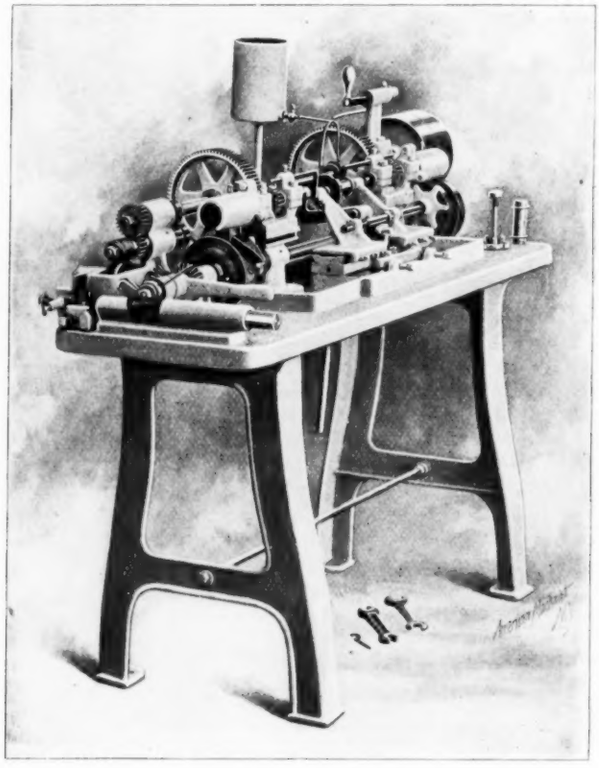
In operation the tube is inserted at the right and is pushed to the left until it strikes the adjustable stop. In this position it rests upon the bearing rolls immediately below the cutting disks, and the operation of the handles upon the eccentric shaft at the top of the machine raises all the bearing rolls at once, cutting off as many pieces as there are disks. The adjustment for different lengths of tube is made by simply setting the brackets and securing them in position by the set screws at their bases, as these brackets carry all the adjustable parts with them.

Referring to the illustration of the drilling machine, the driving pulley at the far end of the machine drives the shaft carrying the large gears, each of which drives a small pinion on one of the drill chuck spindles. Through the gearing seen in the foreground a cam shaft immediately below the drill spindles is driven. This shaft carries two cams, one of which is seen on the near end of the machine, the office of which is to feed the drills into the work and to withdraw them when the holes are drilled.

The hubs are carried on suitable mandrels, one of which can be seen standing on the far end of the machine. The hub with its mandrel is inserted between centers carried by the projecting brackets, and the machine is started. The end of the hub nearest the observer is drilled through holes in the flange of the mandrel. The mandrel has notches in its flange, as will be seen, these notches serving the purpose of indexing the work through a ratchet and pawl mechanism operated by the cam shaft. It will be seen at once that the cam shaft must be properly timed for the indexing, as it makes one revolution for each hole drilled.

Two mandrels being provided, the operator loads one while the other is in the machine, time for this being sufficient, as the machine, once the work is inserted, takes care of itself.

The machines are the product of the Fox Machine Company, of Grand Rapids, Mich.



AUTOMATIC HUB DRILL.

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Details of Deep Well Pumps—Geological Conditions in England.

BY W. H. BOOTH.

The information given by Mr. Hill in the "American Machinist" for September 15 is very interesting. In this country there are no pumps so deep as those named by him. A well of 200 feet depth is looked upon as a deep one for a bore hole pump.

It has never been the practice, so far as I know, to pump large quantities of sand. Where the water bearing stratum is a fine sand we endeavor to keep the sand back by means of a sand tube with fine gauze covering put down into the sand and of considerable length, so as to afford a large area of percolation. In America it is the habit to put down the pump barrel in the lining tube and fix it there by some grip device, but here we never put down the barrel except hung upon a long rising main. Thus in a well lined with tubing 10 inches diameter, we would put down a rising main of 8½ inches, at the end of which would be the barrel 8 inches diameter, this barrel being of gun metal ½ inch or even ⅝ inch thick. Obviously, by abandoning the sep-

arate rising main the barrel might be made of 9 inches or even 9½ inches diameter. Some people who do not realize the conditions properly put in barrels larger than the pipes by which they are hung, and if the bucket and ends are wanted drawn the whole pump requires to be drawn with them at a very much enhanced cost. We do not usually tap the buckets underneath to lift the lower valve, as the lower valve requires less frequent withdrawal than the bucket. Some makers use metal lower valves with a basket handle to lift by. The lower valve, which is in a taper seating, of which the basket handle forms a part, is often lifted simply by a hook which is let down by means of half-inch wrought iron pipes. A better plan is to have a tapped boss in the top of the handle and lift by a screwed rod with the same pipes. Some pump makers, however, use a lower valve of disk india rubber, as shown in the sketch, with a curved guard above, and the bolt which holds together valve seat and guard has a top projection on which may be screwed a tapped boss hung from the same half-inch pipe rods above named, and kept nearly central so as to strike truly on the bolt by means of a couple of disks or a + of wood fixed 2 feet apart

LOWER VALVE.

near the end of the rods, so as to nearly fit the barrel. The disk valves act very well up to 200 or 300 feet of total pressure, and how much beyond this I do not know. I have found them perfect after four years' night and day use under about 180 feet, both in valves and buckets. Iron rods are very heavy, but are almost invariably used with brass box couplings. They cost much less to make than wooden rods, but ought not to do so. No one but myself, however, so far as I know, uses wood, and so far I have done so for few pumps only, though successfully. There was no flotation owing to weight of the joint pieces and the shortness of the rod lengths, but there was, of course, materially less total gravity, and where long lengths are possible there would be a material flotation.

Rollers, I think, are a mistake. Every roller implies a pin, and if buckets are not tight they are not needed. Does Mr. Hill consider that by using several cup leathers in a bucket the stress on each of them is reduced? I am afraid of cup leathers under deep lifts, because they tend to turn over, and where a pump has to run for years night and day there is trouble if buckets give out.. There are no really deep wells in Great Britain. Few borings have been made beyond 1,000 feet, and probably but one or two beyond 2,000 feet. Deep borings are not favorable to water supply. Of three I have myself made beyond 1,200 feet, one was done for scientific research and was dry; a second was a successful and overflowing well from a stratum whose existence was a little speculative: while the third produced salt water in small overflowing quantity only. A very usual depth is 200 to 400 feet. The reason of this is that the geological conditions of this country are peculiar. All the strata are much inclined, and in a journey of 200 miles one may travel over almost every known stratum from the top to the bottom of the geological scale. The country is thus divided into a series of comparatively narrow bands, roughly classible into permeable and non-permeable, alternating with one another. Hence, no matter where a well is to be bored, there is usually at most but one impermeable stratum to be pierced in order to reach water, and even some of the so-called impermeable beds contain sufficient water to supply even a brewery. It follows, therefore, that within a very small distance we can obtain very varied supplies of equally varied quality as to hardness. It also follows that every boring requires special consideration, and cannot be estimated from one only a quarter of a mile away, unless, perhaps, along the strike of the stratum. Only lately it came to me to lay some pipes from a well to a house. The well was very near to the base of the chalk and could only secure practically surface water. The house was only 500 feet from the well, but it stood on the slope of a hill well on to the lower greensand, which is the fourth stratum from the chalk, the upper greensand and the gault intervening. Thus, while a water supply might involve some hundreds of feet of boring at the site selected, a boring half of the distance from the house need only have been taken sufficiently below the water level, for it would have started in the water bearing rock. Between London and the sea, at a point 50 miles distant, there are four distinct recognized water bearing strata with alternating clay strata. These four are repeated, this being a basin shaped district. There are very numerous faults in between, so that an infinite variety of prospects is met with in this short distance, and in three bore holes put down on a line of about 8 miles one drew its supply from stratum A, the second from stratum B and the third from both. Taking England as a whole the strike of the rocks lies on a line from northeast to southwest, so that in traveling from London across the strike of the rocks, or from the southeast to the northwest, we run from new to old rocks. Obviously we travel from one kind of soil to others very different, and from strata producing one mineral to strata producing very different minerals. Seeing that all trade depends on exchanging things one has for things one has not, it is easy to think out a railroad that will pay for such a line must run from stratum to stratum of different kinds in order to act as a means of interchange. It is an obvious fact that, almost without exception, the railways of England which pay the highest dividends are those which run across the strike of the rocks. There is one notable exception to this rule, and this railway is not really an exception, for it forms one of the routes to America, and really taps a different stratum in that respect. All our best pre-railway great main roads may be similarly classified. In a country so small as this and so very thickly populated the geological influence can be easily studied.

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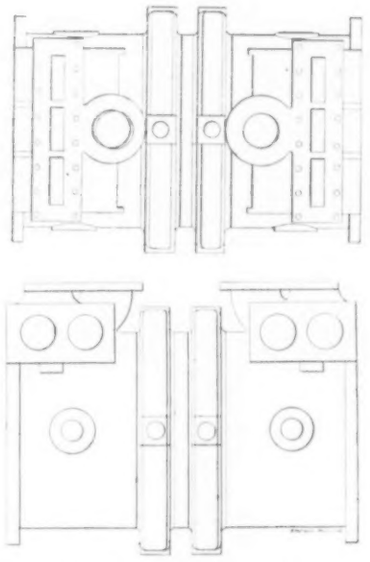
Casting a Corliss Cylinder.

BY R. H. PALMER.

Among builders of heavy stationary engines a difference of opinion exists as to whether their cylinders should be cast vertically or horizontally, some claiming



THE CYLINDER TO BE CAST.

that they get better results where they are cast on end, in the way of sounder barrels, fewer blowholes, less dirt and a smaller percentage of bad castings, while others claim that a cylinder of the Corliss type is more satisfactory cast horizontally and with the valve seats vertical. Among the latter was William H. Harris, builder of the Harris-Corliss engine. Among the many styles of engines built by him for special work was a jacketed compound, with cylinders 16x48 inches and 32x48 inches. The 32x48-inch

casting weighed 14,656 pounds. The small cut is a sketch of the cylinder.

I would call attention to the way of holding the jacket core by using a hollow bolt, and at the same time using the bolt to bring off the vent from the jacket core. By referring to the sketches it will be seen that there were quite a number of cores to set, and to get the gas off as it ought to be was a problem. The bushings running from pattern to bottom board, and top of cope, were all cast with 2-inch holes through them, see Fig. 3, and when the nowel half was rammed up the bushings were placed on the jacket prints, see Fig. 4, thus bringing iron and iron. The space, about 3-16 inch, between pipes and bushing was next filled in with sand, Fig. 2 *d*; then a plate with a good lot of thick paste on it to fit it to the uneven surface of the bottom board was put on; then the nut on the end of the pipe was put on and screwed up, see Fig. 2 *c*, thus forming a hollow bolt, to which vents in lower half of jacket core had been brought, thus helping to hold the jacket core and at the same time taking off the vent from the lower half of the jacket. The iron post of the arbor meeting the bushing, resting on binders prepared for it. The cope was next tried on and found to fit all right, as everything had been correctly measured, and was then set to measure. The joint of the mold was then pasted around the outside, and the cope was put on for good, gate sticks, or sprues, being put in where greensand run-offs were to be built and bolted down; then the joint was rammed in with new molding sand. The space between the flask and the center core was rammed up, and boards, as in Fig. 9 *a* and *b*, rubbed to a bearing. Iron blocking was then put on the ends of the flask, the binders were low-

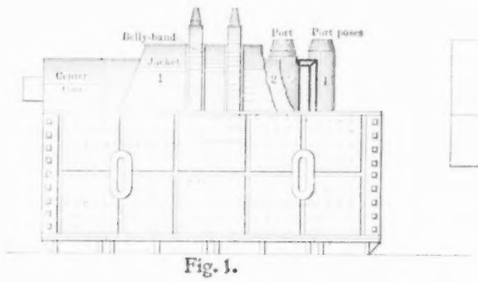


Fig. 1.

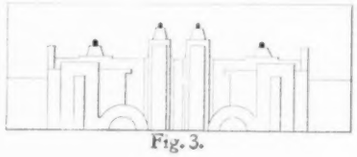


Fig. 3.

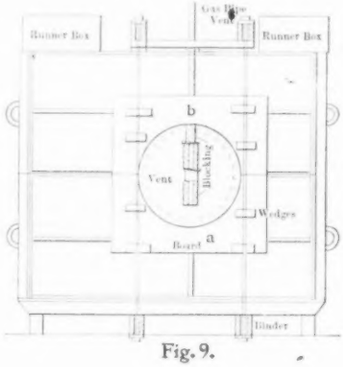


Fig. 9.

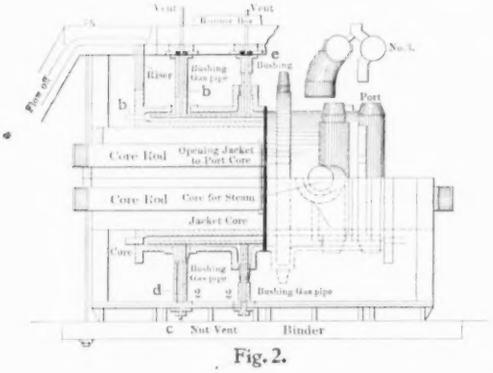


Fig. 2.

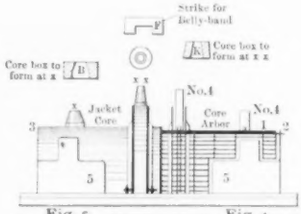


Fig. 5.

Fig. 7.

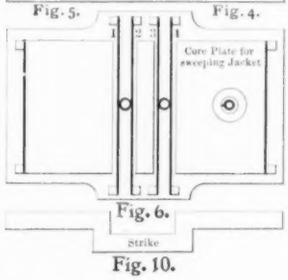


Fig. 6.

Fig. 4.

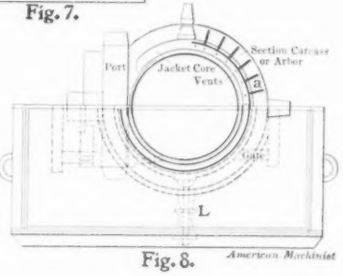


Fig. 8.

Fig. 10.

MOLDING A CORLISS CYLINDER.

prints of the jacket core, false prints having been turned, and screwed on to the regular prints, which fitted holes in the bushings, thus keeping the bushings from slipping sideways, as they were required to be positive, and to reach high enough for the bottom boards to bear on them, see Fig. 2. In ramming up the cope the same method was followed. When ready the nowel was placed on timbers lying across a pit, as it was necessary to get under it.

The nowel half of the jacket had to be set first. Bolts made of double thick 1¼-inch gas pipe were screwed into posts of the jacket arbor, which had been tapped to receive them, and the core lowered into the mold, the iron posts of the arbor, meeting the bushings, Fig. 8 *a*, as the jacket posts came to the top of the and the pipe bolts so packed around, stopped any danger of a run-out around the lower vent.

The port posts were next set, then the center core was hoisted and run in endways between the jacket and the post cores, see Fig. 8. The top half of the jacket was next hoisted and set on top of the first half of the jacket core, and when at the right hight bolted to the lower half through the lower rib, places being left in the sand of the jacket core to handle set screw or bolt, which holes were afterward filled up and dried with hot irons, the tapped holes in the lower half of the jacket arbor being used for eyebolts, to handle in setting the core, while the upper half was set by using eyebolts screwed into posts of the arbor. The mold was then lowered into the pit, ered onto the blocking, running lengthwise of the flask. One-inch bolts were then used between the binders, boards being put on, and wedged between rod and board, and nuts screwed home.

While this was being done the cotton waste put in the bushings was removed, so that no dirt could accidentally get into the vents, and the gaspipe bolts were screwed into the posts of the jacket core through the bushings, Fig. 2 *b*, and calked around; then the large nuts were run down to the right hight, Fig. 2 *e*, on these gaspipe bolts, and small cross-binders were put across the nuts, whose ends ran under the large binder. The runner boxes, with the runners built of dry sand, were put in position and secured, run-offs built, shavings placed under the nowel running to the vents,

rags dipped in oil were wound around the gaspipe bolts for lighting vents in cope half of jacket and ports.

Skimmers, rods to fit holes in sides of flask, where rods had been rammed up in the mold and then removed to help the mold dry sooner and vent, were at hand in case of run-out.

Men were told off to handle the ladles, skim, watch risers and light vent. What to do in case of accident was arranged for and pig beds built for any extra iron. Every man knew just what was expected of him and what to do.

At the word No. 1 started his ladle, and when he had enough iron in the mold to what I call cushion, No. 2 started. The iron was going in pretty lively and with the vents blazing out of the flask it looked like a small house on fire.

"Up!" shouted the man at the riser, and not a leak, not a quiver. Eighty seconds was the time occupied in pouring.

At the time this pouring was going on a 54-inch furnace was running, so there was a little to do for a foreman. Yet if a man plans his work, and keeps ahead of it, and does not let his work get ahead of him, he can handle considerable. Some of our heats ran to 26 tons. It needed, with men on the cranes, twenty men to pour that cylinder. It was churned on the two end flanges and on the port boxes, the men skimming taking the ports and the men lighting the vents the flanges, and let me say that I want the risers to any piece, whether made in dry sand or green, if of any weight, or if a small finished piece, kept covered while pouring.

The cores shown in Fig. 2—8 were for holes used in breaking out the jacket arbor, which was scored around the ports, which were first broken by downward blows; then the arbor was easily broken out. These cores were first set to a gage.

The plate on which the jacket core was swept up, see Fig. 6, was of iron, with a half circular plate, measuring the inside diameter of the jacket core, bolted on to it, see Fig. 7 *a*. Around this was a flange, the hight from it of the thickness of the jacket core on each end, while the belly bands of the jacket core were formed by flanges, Fig. 6, 1, 2, 3, 4. In making this core the jacket arbor, Fig. 5, 1, was placed on plate, the two end flanges being bolted on; ⅜-inch rods for vents were run under the arbor, Fig. 5, 6, through holes in flanges, Fig. 7, 1, the sand rammed around and struck off, using strike, Fig. 10. The flanges for forming belly bands were next bolted on (see section core arbor, Fig. 6, 1, 2, 3, 4), and cinders and straw used to connect vents where the rods were, with holes in ports of jacket arbor, strike *F* being used on these flanges. The prints of jacket core were made up largely of rags covered with very thick blacking, and some fine sand, wound around the tops of the iron posts of arbor and formed with core boxes in halves *K* and *B*. You will see on the section of jacket core arbor, see Fig. 8, 2, a lot of points cast on to jacket arbor to carry belly band. After placing on carriage to run in oven the vent rods were removed, and when dry, after being blown through with bellows, were stopped up, care being taken in making jacket core that no vent should come near the surface, to have a run-out. The jacket arbor is not blunt on the ends, but beveled to an edge, and kept away some 1¼ inches from ends of jacket. I figured, as the length of the jacket was 72 inches, the expansion of the arbor would be not less than ¼ inch on each end, or at least ½ inch in all. Taking that fact, with the shrink of the cylinder itself, the 1¼ inch was left so the bevel edge of core arbor would have a chance to be forced into the sand, and not have a blunt edge to help hold against the shrink of the casting. Also do not cramp the vent; a free vent is a blessing, but a cramped vent, if it don't make a curse, it is a curse. Remember straw, also cinders, are very useful in forming channels for vent.

I used for rods some very heavy rods cast purposely with lugs or arms on the sides for the center core, which being 9 feet long by 31½ inches diameter, was quite heavy, and the core was bolted together in center, Fig. 2, 5.

While I like a cast iron barrel with prickers to make a center core of cylinder on, would say don't let the prickers, or lugs, or whatever you may call them, come too near the surface. Remember your cylinder will be shrinking by and by, and if it binds too hard you may get a cracked cylinder; also your core barrel will expand. If you don't believe it, look inside the barrel after the cylinder has been cast a short time. Thickness outside of jacket core, 1¼ inches; 2 3-16 inches nowel side, 2 inches on cope on barrel of cylinder.

Iron used	4,695 Carwheels
Charcoal iron	4,910 Copake 4
Charcoal iron	4,910 Copake 3
	633 Scrap
	920 Cram, 2 plain
	3,025 Powelton, 2 X

Some other work took the iron remaining over; had 17,000 in two ladles. The above mixture was perfectly satisfactory, the cylinder boring out good and clean, and pronounced just right for hardness. Any foreman accustomed to the above kind of work is always glad to hear "Bored out all right!" and "Just hard enough!" which is a point it is hard to always determine. I never received a new lot of iron but I was always watching the first few casts. A number of times I have heard men say: "I mixed the iron just the same as in the last of that same size cylinder. I do not see why it should come any harder." If he goes and looks at the pile of broken chilled carwheels he will find the chill running deeper in some than in others; the deeper the harder, and in others, maybe, particularly if Southern wheels, the little fine lines, or legs as we term them, which should run from the mottled iron next to chilled face into the gray iron, are not very distinct, and the wheel has the appearance of having nearer two distinct kinds of iron in it, or rather the line is more distinct between the chilled face and the gray iron; not as it should be.

When having such wheels as the first named I put them into other work than a cylinder, as I found that those wheels, where the line of separation between chill and gray was very distinct, and with an absence, or nearly so, of the fine legs referred to. Those wheels did not make as perfect a mixture as the second class named, which, by the length of leg, would show a good mixture of charcoal iron.

In making cylinders, in dry sand especially, it is the rule to have quite a joint fin next the cylinder casting to avoid any danger of crushing when the mold is put together. A mold made of green sand or common molding sand will give a little, while a dry sand mold, after being dried or baked, is a hard, porous mass, and if the upper half rests, or bears, too heavily on the under half a crush is the result; hence greater fins on castings made in dry than on those made in green sand.

It is this fin, and the fins generally, which the foreman is very apt to look at to judge something as to the hardness of the cylinder.

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Shrinkage of Steel Straightedges.

Referring to an article we published some time ago about "seasoning" castings and hardened steel, a correspondent tells us his experience with a couple of straightedges. These, when received from the maker, were tested and known to be all right. They were used very little, and at the end of about six months were tested again and found to have shrunk in the middle about .001 inch, so that both edges are now concave by about half that amount. Unless there has been a mistake somewhere this is an interesting example of what steel will sometimes do for a time after it has been hardened.

▲ ▲ ▲

But There Were Two Ends.

Irascible Lieutenant (down engine room tube)—Is there a blithering idiot at the end of this tube?

Voice from the Engine Room—Not at this end, sir.—From "Punch."

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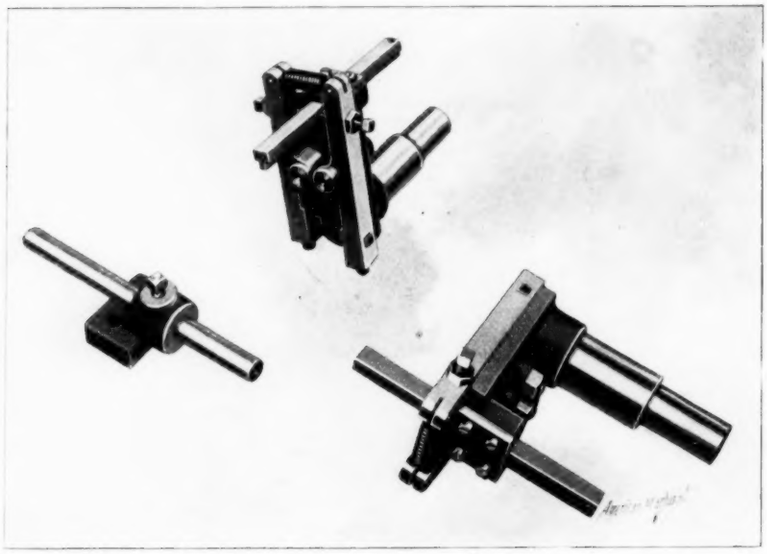
As announced elsewhere in this issue, the office of the "American Machinist" has been removed to 218 William street, New York.

A Taper Turning Tool for Screw Machines.

The half-tones show a taper turning tool made by Messrs. Alfred Herbert, Coventry, England, and used upon the screw machines built at that establishment. Fig. 1 shows the taper tool as in use upon the screw machine, it being set for turning bicycle pedal pins, while Fig.



THE TAPER TURNING TOOL AND STOP.

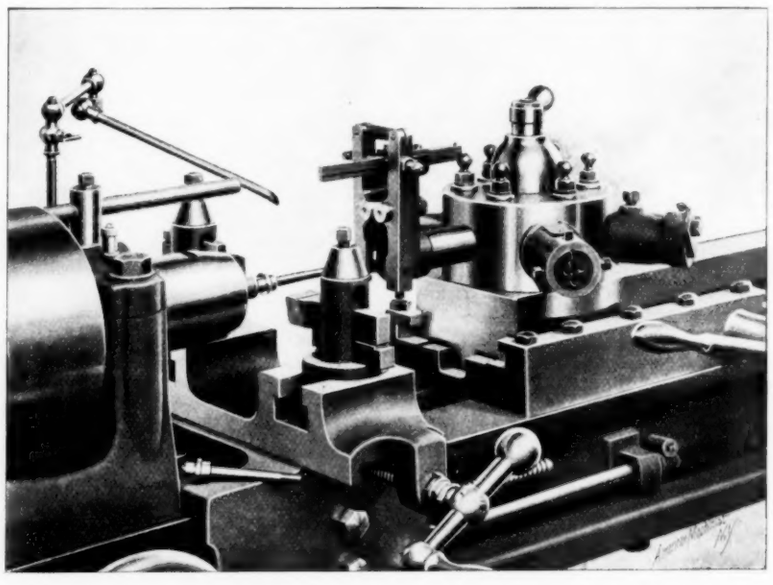
2 shows the construction of the tool. It consists of a holder or round shank with an upright piece in front, upon which are two pivot pins with two upright arms mounted on them. The shank is large and has a hole through it, into which the piece that is being turned may project. The arms are connected at the top by a strong tension spring, and they each carry at their lower ends a cutter, one of which is of course reversed. Near the upper ends of the arms, but below the spring, are swing levers carrying adjustable hardened set pins bearing against a tapered steel bar, which has on its lower side a parallel tongue, which fits in a corresponding slot or guide in the upright part of the body of the tool. The upper portion of this sliding bar is made of such a taper as will by the gradual closing of the cutters give the required taper to the piece to be turned. An adjustable stop rod is attached to the headstock, and as the tool is fed forward the sliding bar comes in contact with the end of the stop rod, and then as the turret advances into its cut the tool slides move forward along the taper bar, which opens the tools accordingly. The tapered bar is, after each cut, pushed forward by hand until stopped by the pin projecting on the top. As the tension spring is above the taper bar the slack of the pin joints, if any, is always taken up. This tool, it will be noticed, will turn not only tapers, but also curved outlines if not of too small radius.

Letters from Practical Men.

Light for Photography and for Machine Work.

Editor American Machinist:

The editorial in a recent issue of the "American Machinist," entitled "Photographs and Photographs," which called attention to the admirable shop pictures reproduced in the same issue, and which gave the European photographers credit for doing rather better work in the line of machine and shop photography than we do in this country, while perhaps all correct, and if correct then also just, seems still to invite or provoke a little talking of it over.



AN ENGLISH TAPER TURNING DEVICE FOR A TURRET LATHE.

The photographer, like the molder, also the machinist and most of the other fellows, is a much abused individual, and he perhaps has it rather harder than any of the rest. The molder has to make castings from patterns that won't draw, the machinist has to plane or to turn castings that steel won't touch, but the photographer, whose supreme tool is the sunlight, has to make good pictures without light, or with the light all wrong. Of any picture which is not altogether satisfactory it is usually only fair to ask whether it was the light or the photographer that was to blame, and in the perfect and admirable picture also it might be proper to ask whether the credit is due to the photographer or to the light. The reference to the pictures of the Reinecker shops makes these questions specially pertinent, for it is almost self-evident in their case that "the splendid light from the roof," of which the description spoke, had more to do with the perfection of the pictures than any peculiar skill in the adjustment of the camera or in the manipulation of the plate that the individual photographer may have possessed. And what is true concerning this particular shop and the photographs of it is probably true also of many other European shops, and has much to do with the superiority of their shop photography. From what I can learn of those shops, there is probably no particular in which they are usually to be found so superior to our own as in their light. They use the skylight so much more than we do. Their shops are apt to spread in every direction, and they may be as broad as they are long, and splendidly lighted in every nook and corner, while we run to long and narrow designs, with struggling side lights crossing each other. Let the photographers exchange shop conditions and it is doubtful if the characteristics of

their individual work might not also be reversed. It is worth while to talk over this thing, not for the sake of the photographs, but in the interest of something vastly more important. No shop is designed and arranged with any thought, usually, of the photographic conditions, or with a view to the production of the most perfect pictures. If any shop proprietor is disposed to regard his shop with satisfaction, and if any mechanical visitor is led to praise it, the prevailing reasons will be in the facilities afforded by the shop for turning out the most and the best work. Curiously enough, however, here photography comes in again at once. Every workman carries a couple of cameras, and whatever occupation he may at any time be ostensibly engaged in his constant and lifelong work is instantaneous photography. In this view of it the photographic shop conditions become of the first importance, and the actual photograph is at once in evidence as to the most important of all work facilities. The photo reproduces the same picture that the man sees; the most perfect plate, which reveals most perfectly and most equitably everything within the field of it, tells us that the man also must see most clearly from the same point and with the same distribution of light. When the photo shows halation or blur or general or local indistinctness it is very certain that the man cannot see as well as he would where the perfect photo is taken.

Every shop proprietor, should he stop to think of the matter after the above fashion, must be at once anxious for his men to have the best possible light, so that they may take the best possible photos; or, what is the same thing, so that they may see what to do and what they do with ease and clearness. Eyes see as much better under some conditions than under others, as much as photos from one shop are better than those from another. If we do not show as good shop photos as any that are produced in the world let us see to what extent the shop is to blame for it, and keep the remedy in sight for future building. There has been much designing and building of shops, and much thought has been given to the securing of various specified conditions, but that the importance of "the splendid light from the roof" has not been fully kept in view is evidenced in too many American shop photographs.

TECUMSEH SWIFT.

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Cutting Tool Criticisms.

Editor American Machinist:

The planer tool which Mr. Cameron shows in the issue of October 27, if not altogether a novelty, is still interesting. It seems to embody more completely and successfully than I have generally succeeded in doing the two or three points that I believe to be most essential in a metal cutting tool. It is easy enough to believe, as Mr. Cameron tells us, that the tool would come out at the end of the cut without tearing the corners, also that it would cut with a minimum expenditure of power for the chip produced, and that it would cut the work smooth and without a suggestion of chatter.

The hanging of the cutting edge back far enough to insure that if any springing occurs it will spring away from the surface to be cut instead of springing into it, thereby putting it when cutting in stable equilibrium, instead of unstable, is undoubtedly correct. It is to be noted, however, that the back corner of the oblique front edge will spring away more in a vertical direction than the more advanced corner.

It is quite common to use a spring tool for light finishing cuts, but usually with

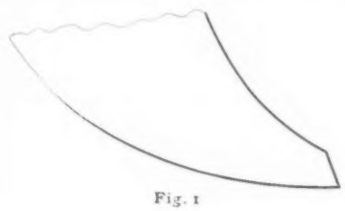

Fig. 1

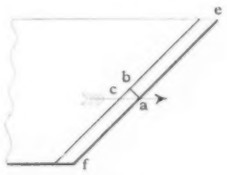

Fig. 3

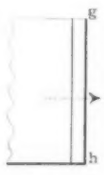

Fig. 2

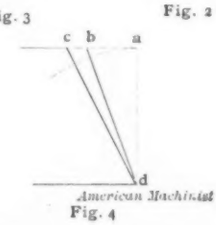

Fig. 4

WHAT THE OBLIQUE FACE DOES FOR THE CUTTING ANGLE.

the cutting face square with the work in front, instead of oblique, as shown by Mr. Cameron. Not all mechanics even yet appreciate the additional acuteness that is given to the cutting edge in the act of cutting by this obliquity of the front, although this was shown in the columns of the "American Machinist" two or three years ago. To have a tool cut smooth and easy it is quite desirable to have the cutting angle of the tool as acute as possible. We all know what a difference there is in the cut of a tool between one perfectly flat in front and one that has a little "hook" to it. A difference of 10 degrees in the front angle of the tool gives a remarkable difference in the ease and smoothness of cutting and in the character of the chip produced. I suppose that, if it were otherwise equally possible to use it, a tool for cutting steel or iron should be as acute as one for cutting wood. When we have a material for cutting tools that is relatively as hard and stiff as compared with steel as steel now is as compared with wood, we will be able to say this, but not until then. In the meantime we will go on and get all the acuteness or lip to our tools that we can, and this obliquity of the front of the tool is one thing that helps us to it. It may be worth while to just figure out what the obliquity does for the cutting angle. This is, of course, entirely independent of the spring feature of the tool, and applies just the same to tools that are as rigid as it possible to make them. Say that the front or cutting angle of the tool is 20 degrees back from the vertical, as in Fig 1. This is probably at least up to the average, and it is not often that tools have more rake than that if cutting good hard metal. If the tool is square in front, as in Fig. 2, and cuts in the direction of the arrow, then the actual angle of the tool will be also the cutting angle; but if the front of the tool have a horizontal obliquity, like that of Mr. Cameron, and as shown here in Fig. 3, then the cutting angle is evidently more acute. The tangent of the angle *a d b*, Fig. 4, formed by the actual face of the tool *a d* and the line *b d* drawn vertically from the point of the tool will be *a b*, while the tangent of the angle parallel to the cutting plane will be *a c* of the angle *a d b*. Referring to Fig 3, the obliquity being 45 degrees, *a c* evidently equals $\sqrt{(2ab)^2}$. The tangent for an angle of 20 degrees, or *a b*, being .364, *a c* will be .547, and this is the tangent of 27 degrees 14 minutes, so that all this additional inclination backward of the cutting face in its actual relation to the work is secured by the horizontal obliquity. If the face was placed still more obliquely the angle *a d c* would, of course, be still more increased. By this device the advantage also is secured of a longer cutting edge for the same work, as *c f* is, of course, longer than *g h* in the ratio 1: $\sqrt{2}$.

TECUMSEH SWIFT.

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Can We Feed a Boiler for Nothing?

Editor American Machinist:

The letter of Mr. Tecumseh Swift, October 20, states that a condenser will draw its supply of water from above its level or 20 feet below its level, and claims that there is more work done in one case than in the other. It is quite clear to my mind that the resistance must be the same in each case to get an equal flow. If the pipe is the same size and length in each case, it is obvious that there will be a greater flow when the water is received from the upper supply, because there will be less resistance. Now, if a stop valve is used to regulate the flow and make it the same in each case, then the resistance

caused by the stop valve in one case is just equal to the resistance caused by the greater lift in the other case. At least that is the way it looks to a person who has studied electricity.

His plan for feeding a boiler will work just as he says; but it will not be in any hurry about it, because the receiving chamber will be full of high pressure steam at each discharge, and the condensing water will not rush in before he has time to smoke. If he wishes to make it automatic he should study the action of an ordinary pulsometer, and then try an injector. It will cost less, will be more convenient and more economical, because there will be less radiation

JOHN JETT.

San Francisco, Cal.

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Ball Bearings.

Editor American Machinist:

Mr. Benns' article on ball bearings seems to be of a rather too complicated description for ordinary use. In my own experience I have had to use a good many ball bearings for rough work, and they were roughly made in the usual way; that is to say, we ran the balls in curved grooves, the grooves being a little larger than the balls. They served their purpose well enough, the paths being hardened steel, but there was, of course, a good deal of grinding. I was thus induced to look into the correct designing of ball bearings with a view to finding how to design them, so as to obviate the grinding action, which must occur when the ball bears at improperly proportioned radii. The result was that for my purpose I found the construction shown in Fig. 1 to be necessary and correct. I will suppose the case of a swiveling crane hook. The center of revolution is at *O* and the radius of the ball path is *O h*. The problem is to find the form of path. For this purpose I draw *O A* and *O B* at equal angles with the horizontal, cutting the ball at 1, 2, 3, 4. Then the cone 1, 2, 3, 4 is a cone suitable to run on the inclined paths *O A* and *O B*, and such a set of cones suitably held, radially pointed to *O* would form an excellent crane post or swing bridge or turntable live ring. If correctly drawn we shall find that the line 1, 4 bears the same ratio to the line 2, 3, as does the length *O* 1 to the length *O* 2. In other words, the section of the ball on the line 1, 4 is a circle whose circumference, as compared with that of the section at 2, 3, is equal to the ratio of the inside and outside circles of the path. Such a cone rolls without grinding. It is our duty now to find a circle to pass through the four points 1, 2, 3, 4 and to cut away the paths everywhere except at these points. The circle we have already got by construction. It is the ball circle. To find the paths on which this ball will roll without grinding we must now join the four dotted radial lines from *h*. Then the short lines at right angles to these four radii are tangents to the sphere, and each pair includes the angle *x*. A tool ground to this angle *x* and properly fixed in the lathe will serve to finish the grooves in the steel rings which form the ball paths. By theory a ball can only make contact at a point. As soon as it wears itself a groove it must begin to grind. For a three-point bearing either of the paths may be replaced by a single flat surface. Balls are not scientific as bearings; they imply great load concentration and cones are better, as they make contact on a line, not on a mere point. But unless of large dimensions cones cannot be used, as they cannot be kept truly in position. Now, a ball in grooves like Fig. 1 cannot get out and is theoretically correct, and good enough in practice for many purposes. I cannot say if the system above is much employed. As far as I have seen it is not employed in bicycles, though I believe it ought to be. Bicycle grooves seem to be curved, and there are other considerations come into play. At the same time it seems desirable that, however designed, it is necessary to take into acount the principle of proportional radii and path circumference, and also the results of wear, in order that a bearing originally correct may not depart too far from correct form when worn. All this can be developed if only we start out with the correct idea, as shown in the figure.

W. H. BOOTH.

London.

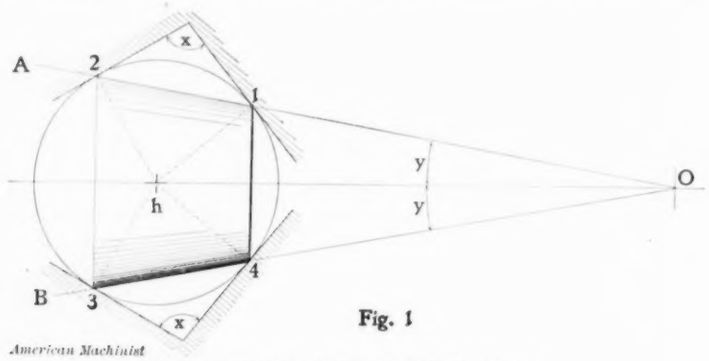

Fig. 1

BALL TRACK FOR THRUST BEARING.

Oil for Belts.

Editor American Machinist:

In reading the issue of October 13 of the "American Machinist" I came across the letter by Mr. J. J. Wilmore, entitled "Cylinder Oil as Belt Dressing." He stated that he would like to hear from others who have had experience in such lines, and I will give you my experience. I was engaged to take charge of a plant using about 75 horse-power for machinery and tools, among which was a double plunger pump driven by a 6-inch double-ply leather belt, which was but a few months old. The belts were supposed to be kept in running order by using a special belt dressing. The men in charge of the pump had told the "super." that the belt was not wide enough to drive it, so the "super." told me to investigate and do what I thought to be necessary. The belt dressing had done great work, for it had pulled pieces out of the belt in several places. I had the belt taken off, scraped, cleaned and put back. I then applied a mixture of castor oil one part to neatsfoot oil about three parts on the outside of the belt, giving it time to soak, the face being just moist. The effect was all that could be desired, and I received orders to treat all the belts in the same way. I mentioned the expense of the dressing to the "super.," but he told me that it was cheaper than buying new belting. During the remainder of my time there, three years, there was no more trouble with belts, and no more "special dressing" was purchased.

H. R. T.

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Micrometer Subdivisions of Measurements.

Editor American Machinist:

We all know that the books teach that the yard is the standard unit of linear measurement in the United States, but at the same time we just as well know that with the yard we have next to nothing to do in the machine shop. In fact one may pass many months—I was about to say years—in a machine shop and never hear the term mentioned. Still the knowledge is fully as current that the inch and its parts—the real unit of measure in our shops—is derived from the yard; and it is far from my intention to discuss the origin of any unit or division thereof. What I do want to do is to call attention to the needless number of units in use, and to both suggest a partial remedy and to ask for help.

There was a time when in our machine shops a sixty-fourth of an inch or its half, was the smallest unit employed or needed. Those should have been happy days, not because of any lack of accuracy or painstaking—that is supposed to be quite modern—but because the microme-

ter, with its decimal system, had not yet introduced that endless translation from binary to decimal and decimal to binary parts. Such things may be common in some places, but I have seen very few drawings that seemed to be made to be used with a decimal micrometer. And, most certainly, a measuring instrument that divides the inch into thousandths is very poorly fitted to use with drawings on which sizes are given in binary parts. We hear much of the great difficulties to be encountered in a possible change from our current system of measures to the metric. To my way of thinking we have already surrounded ourselves with similar difficulties in needlessly mixing binary and decimal systems of dividing the machine shop unit, the inch, and we have no relief in sight. If we were in a transition stage from one system to another we might struggle on with hope. We might at times believe that, at least for coming generations, the burden would be less. But as it is, the difficulty grows greater with the constantly increasing manufacture and use of measuring instruments decimally divided, while sizes continue to be given to us in thirty-seconds and sixty-fourths. It certainly would require a genius to contrive a less convenient lack of system. It is my belief that the constantly recurring binary fraction of a thousandth in all translations of binary to decimal parts of our inch has hindered the introduction of the micrometer more than doubling its cost would have hindered it. It is very easy to see why micrometers are made as they are to-day, but very hard to see why they should have first been made so, unless that it was not supposed they would ever come into general use, but were only designed for the ultra scientific.

I would not be understood as advocating fewer micrometers in general machine shop use. There should he hundreds where one is now used. I will not take second place to anyone in my admiration of the micrometer, but I am grieved that it need be so far from what it might be if we had a direct correspondence between the reading of the drawings and the reading of the micrometer.

And what I want to suggest is: As there is small hope of reforming the drafting room, reform the micrometer by making the pitch of the screw some binary part of an inch, say 1-32, and divide the revolution of the screw—the micrometer thimble—into thirty-two parts. You would then have your inch divided into 1,024 parts, which is small enough for most purposes. If something smaller is wanted introduce a vernier and divide into eighths, or as fine as may be required. I would also suggest that some name be adopted for this 1,024th part of an inch, which would be more convenient than "thousandth" or "tenhundredtwenty-fourth."

WM. S. ROWELL.

Cleveland, Ohio.

▲ ▲ ▲

Rivet Dimensions.

Editor American Machinist:

There are many people who use rivets, but few who know how to construct them in their right proportions. For the convenience of such I offer the following:

The head of the snap head, or spherical head, rivet, Fig. 1, should have its diameter $A\ B = 1\ 7\text{-}10$ of diameter $C\ D$ of rivet and hight of head $E\ F = 6\text{-}10$ of $C\ D$.

Construction: Draw circumference of rivet $H\ I$, then from L as center draw

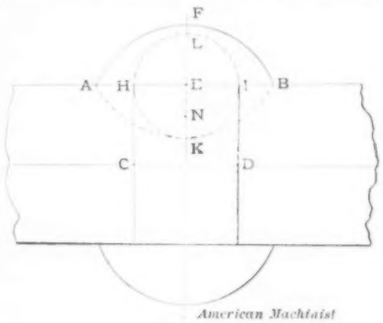

Fig. 1

PROPORTIONS OF SPHERICAL HEAD RIVET.

arc $A\ K\ B$, and lay off $L\ N$ equal to $A\ E$. Take N as center and with radius $N\ A$ draw arc $A\ F\ B$, and head of rivet is proportional.

The head of the conical head rivet, Fig. 2, should have its diameter $A\ B$ = twice the diameter of rivet $C\ D$, and the hight of head $E\ F = \frac{3}{4}\ C\ D$.

Construction: With the center E and radius $= C\ D$ construct arc $A\ N\ B$. With M for center, when arc $A\ N\ B$ cuts the rivet, take radius $M\ B$ and draw arc $B\ F$,

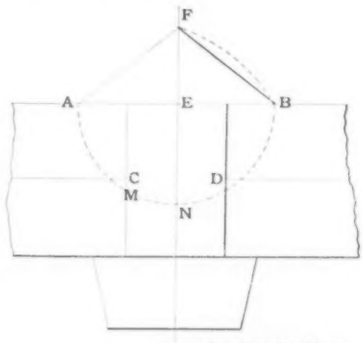

Fig. 2

PROPORTIONS OF CONICAL HEAD RIVET.

cutting the center line at F. The distance $F\ B$ is the slant hight of the rivet head proportional to the rivet.

The head of the pan head rivet, Fig. 3, should have its greatest diameter $A\ B = 1\ 6\text{-}10$ of diameter of rivet $C\ D$, and hight of head $E\ F = 7\text{-}10$ of diameter of rivet $C\ D$, a construction which is not difficult.

The head of the countersunk rivet, Fig. 4, should have its greater diameter A

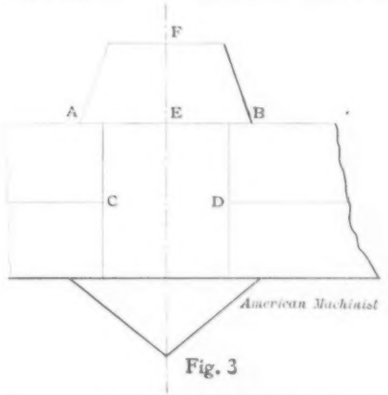

Fig. 3

PROPORTIONS OF TRUNCATED CONICAL HEAD RIVET.

$B = 1\frac{1}{2}$ diameter of rivet $C\ D$ and depth $E\ F = \frac{1}{2}$ diameter of rivet $C\ D$.

I hope that this may be of use to those who use rivets.

O. HERRMANN.

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Weight of Bar Steel by the Slide Rule.

Editor American Machinist:

The slide rule formula for finding the weight of hexagon bar steel, as given in answer to question No. 109 (issue of November 10), will show the weight of bar per inch of length. This, of course, must be multiplied by the length of the bar, which will make two movements of the slide to obtain the result required.

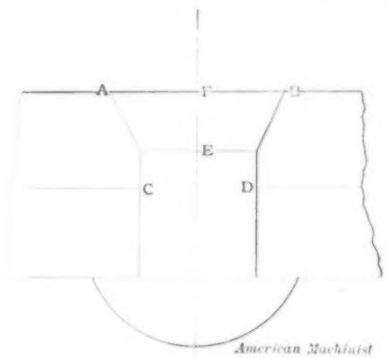

Fig. 4

PROPORTIONS OF COUNTERSUNK HEAD RIVET.

Now as

$$\text{wt. per inch} = d^2 \times .245$$
$$= (\sqrt{d^2 \times .245})^2$$
$$= (d \times .495)^2$$
$$= \left(\frac{d}{2.02}\right)^2$$

the problem may be solved thus:

Find weight per inch of length on A against 1 on B

Set 2.02 on C to d on D

which has the advantage over the method

given by you that the rule is now in position to multiply by the length of bar (in inches) without again moving the slide, which will save 50 per cent. of the time required and the same amount of liability of error. L. S. CHAPMAN.

Schenectady, N. Y.

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The Cube and the Tetrahedron.

Editor American Machinist:

A little kindergarten work may not be bad for a change, especially as I have not seen anything in that line in the columns of the "American Machinist" for a long time. I am like the fellow that comes along, sometimes, looking for a job—I can work on light work or on heavy work, if it is not too heavy. This will pass for a light job, and, as I intimated in my last effort, it was Mr. Olin Scott that "put me onto it."

Figs. 1, 2 and 3 are, respectively, plan and front and side elevations of a cube whose linear edge is, let us say, 2 inches. The cube in this case is not in one piece, but comprises a tetrahedron, or regular triangular pyramid, whose sides are four equal equilateral triangles, and four other pyramids, not so regular but all alike, which inclose and complete the cube. The pyramid is entirely contained in the cube, and nothing appears of it on the outside of the cube but the sharp lines where its flat, triangular sides meet each other. There are, of course, six of these boundary lines to the pyramid or tetrahedron, and six sides to the cube, so that each one of the edges of the pyramid coincides with a diagonal of one of the sides of the cube. The pyramid, in the position shown, does not stand upon its base, but upon one of its edges, and it is somewhat misleading to speak of it as a pyramid when standing in that position. If it were placed as a pyramid, with its base coincident with the base of the cube, and with one edge of it coincident with one side of the cube, it would stick out of the cube on four sides of it, as shown in Figs. 6, 7 and 8. In Figs. 4 and 5 the cube is shown looking at it cornerwise, so that all the sides of the cube, with all the edges of the pyramid as diagonals of the sides of the cube, are shown. It is only the peculiar position of the tetrahedron in the cube that makes it possible to include a regular figure of such large dimensions, and it must always be of interest as a curious thing in itself.

This figure is especially interesting and valuable to us, as affording a neat example of the application of the principle that the square of the hypothenuse of a right-angled triangle is equal to the sum of the squares of the other two sides. The most important of all the rules of the arithmetic to the mechanic is undoubtedly that of simple proportion, but this one of the square of the hypothenuse is a good second. It might be worth while for us to try it on here, and see what it will tell us about this figure.

Say that we want to get the linear and other principal dimensions of the tetrahedron, with the side of the cube 2 inches to start with. The length of any side of the figure is the same as the diagonal of the side of the cube. The side of the cube being 2 inches, the diagonal of the side will be equal to the square root of the sum of the squares of two adjoining edges or $\sqrt{2^2 + 2^2} = \sqrt{8} = 2.8284$. From this we can get the perpendicular hight of one of the triangular sides. By this is not meant the *vertical* hight of the apex of the pyramid, but the length of a line perpendicular to one of the sides of the triangle and extending to the point where the other two sides meet, or to the apex of the angle opposite the side. If this perpendicular is drawn in the triangle, like the line partially dotted in Fig. 6, it divides the triangle into two equal

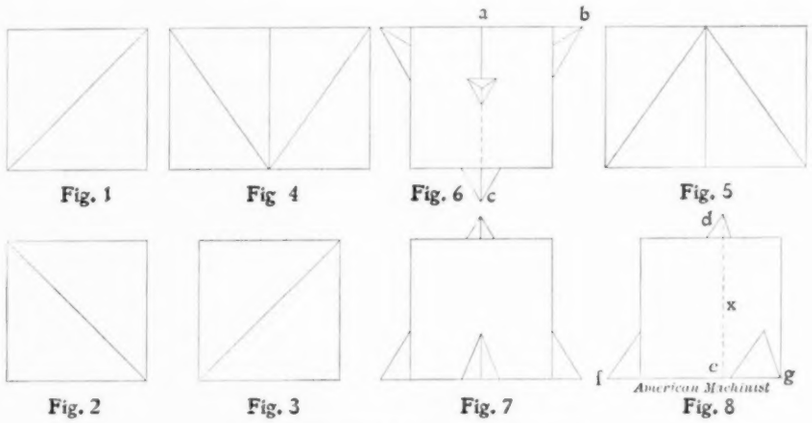

Fig. 1 Fig. 4 Fig. 6 Fig. 5

Fig. 2 Fig. 3 Fig. 7 Fig. 8

THE TETRAHEDRON IN THE CUBE.

parts and meets the side exactly in the middle. We then have the triangle $a\ b\ c$, the side $b\ c$ being 2.8284, as we have just found, and $a\ b$ being one-half of this, or 1.4142, the length of $a\ c$ will be $\sqrt{2.8284^2 - 1.442^2}$. It will be remembered that $2.8284 = \sqrt{8}$, therefore $2.8284^2 = 8$; 1.4442 being one-half of 2.8284, its square will be one-fourth of 8, or 2. We then have $\sqrt{8 - 2} = \sqrt{6} = 2.4495$ for the perpendicular of the triangular side.

The area of a triangle is equal to the length of the base multiplied by one-half the perpendicular hight. We now have the base, 2.8284, and the perpendicular, 2.4495, and the area of the triangle will therefore be $2.8284 \times \frac{2.4495}{2} = 3.464$ square inches.

Now we can see in Fig. 8 how to get the vertical hight of the pyramid, or the length of the line $d\ e$. We need not remember or hunt up what the books tell us about how to do this, and I certainly have forgotten, but we can try it in our own way. The line $d\ f$ is one of the dihedral angles of the pyramid, or a side of one of the triangles, or 2.8284, and $d\ g$ is the perpendicular of one of the triangles, or 2.4495; $f\ g$ is the same, while $d\ e$ is the vertical hight that we want to get. Now in the triangle $d\ g\ e$ or in the triangle $d\ e\ f$ we could easily get the length $d\ e$ if we only knew the length of either $e\ g$ or $f\ g$. We don't know either of these, but we know the sum of them, or $f\ g$, which is 2.4495, and we can get along with that. We represent the length $d\ e$ by x, and then we have the little equation:

$$\sqrt{2.8284^2 - x^2} + \sqrt{2.4495^2 - x^2} = 2.4495.$$

Remembering what the squares of the numbers were, we substitute them and then we have

$$\sqrt{8 - x^2} + \sqrt{6 - x^2} = 2.4495.$$

The subsequent operations are then like this:

$$\sqrt{8 - x^2} = 2.4495 - \sqrt{6 - x^2}$$

$$8 - x^2 = 6 - (2.4495 \times 2)\sqrt{6 - x^2} + 6 - x^2$$

$$(2.4495 \times 2)\sqrt{6 - x^2} = 4$$

$$\sqrt{6 - x^2} = \frac{4}{2.4495 \times 2}$$

$$6 - x^2 = \frac{16}{6 \times 4} = \frac{2}{3}$$

$$x^2 = 6 - \frac{2}{3} = 5.3333 +$$

$$x = \sqrt{5.3333 +} = 2.3094$$

The cubical contents of a pyramid are equal to the area of the base, multiplied by one-third of the perpendicular hight. Then, in this case, it will be

$$3.464 \times \frac{2.3094}{3} = 2.666$$

There are many other particulars that may be figured out by following this further. By using a cube whose side was one, we could work out the other proportionate dimensions to use as multipliers for figures of any size, but these things are to be found in the pocket books. It is well, however, to know something about the making of pocket books, and it is well also to be constantly

making a pocket book of our own by noting down the results of all computations that are made if they seem to be possibly of any future value. There is no better labor-saving scheme than in the avoidance of repetition of identical processes. Once for all is the cheapest that anything can be done.

TECUMSEH SWIFT.

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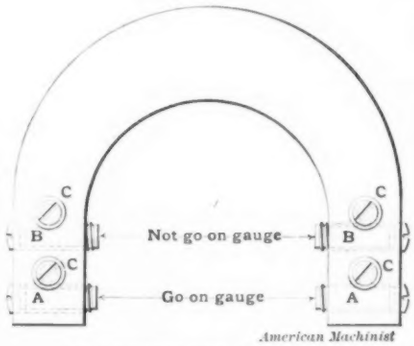
An Adjustable Limit Gage.

Editor American Machinist:

Seeing in the local paper that the Putnam Machine Company was working on a contract making shells for the Government, I took a stroll in there the other day to see those death and destruction dealing monsters in their peaceful existence in a machine shop; or, rather, I was most interested in seeing some of the ingenious appliances contrived for their production, proving to me that even war is in no small measure indirectly promoting mechanical ingenuity.

Some of those appliances were very special in their nature, and would probably interest but a few of the readers of the "American Machinist," but others were such that they would be of general utility in any machine shop. Among this latter class of useful tools I especially noticed a limit gage, used when measuring the diameter of the shells, which was a new thing to me, and by the courtesy of Mr. S. W. Putnam I am permitted to give a sketch of it to the readers of the "American Machinist."

The sketch is almost self-explanatory: The flat pointed screws *A A* and *B B* are adjusted so that the gage can be set for any limit by applying them to round



AN ADJUSTABLE LIMIT GAGE.

disks of standard diameter, and when thus adjusted they are tightened by the screws *C C*. Nothing can be more simple to use or more practical for a lathe hand than such a gage. When a piece is turned so that the "go on" gage goes over and the "nit" gage (as I recently saw it christened in the "American Machinist") does not go on, the piece is right. It is almost impossible, except by gross carelessness, for a man to spoil a piece of work by turning it too small when using such a gage. He can never make mistakes in the gages, as he may be very apt to do when two separate gages are used. As Mr. Putnam assured me that the gage was "nothing new" it may be that many of the readers of your paper are using similar gages, but never having seen anything similar in any advertisement or any catalog, I think there may be more than myself that "never thought of it," but after we have seen it any of us can make it.

PEDER LOBBEN.

Fitchburg, Mass.

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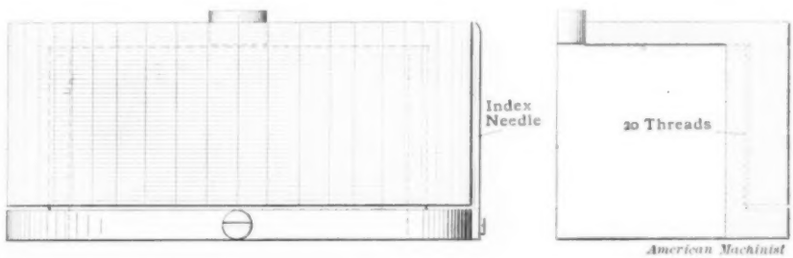
A Micrometer Planer Gage.

Editor American Machinist:

A good planer gage is a tool that should be appreciated by all machinists who are running planers, and I submit herewith a sketch showing a type of gage that I think might have some merit. The tool consists of a round base, or body piece, threaded externally, and an adjustable top piece, threaded to fit it. The top adjusting piece has lines struck around the outside circumferentially at distances corresponding to the pitch of the screw, while vertical lines also are struck around it at equidistant points, dividing it into convenient graduations for calculation, and may be made to read in sixteenths and fractions, tenths and fractions, up to one one-thousandth of an inch. An index pointer is provided to read the measures and a screw to fasten the tool when set to size. Either a steel plug in the center, as shown, or a ring raised on the top, either being ground true, furnishes the surface for the contact. The hight of the whole tool can be made in even inches and the graduations to any division of the same. The screw may be cut, say, 20 to the inch, and by dividing the circumferences into 50 sections a reading of .001 of an inch is easily made. Making the tool of such diameter as will make a circumference of 12½ inches makes the vertical lines come ¼ inch apart, and the markings easily read. The clamp screw is made operative by cutting a fine slot vertically through the bottom piece, and in the base fit a taper screw, which expands the base and tightens the two together. The index or pointer is fastened to the base, as shown. This tool may be of service to some of the craftsmen. There are many modifications of it possible, and as it is simple, of few parts and of fine adjustment, it may serve a good purpose.

C. A. BURTON.

Kansas City, Mo.



A MICROMETER PLANER GAGE.

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Rule for the Size of Drawing Blank.

Editor American Machinist:

In the number of the "American Machinist" for November 10, 1898, H. K. G., Watertown, N. Y., desires a rule for finding the size of blanks for drawing shells from sheet metal.

I would suggest that in addition to the rule given he try the following:

Rule—The diameter of the shell plus the length will be the diameter of the blank.

It is well known that all rules for dies of this kind are only approximate, and I quite agree with the "American Machinist" that it is always best to make the blanking die last.

The pressure on the blank holder when drawing, the quality of the metal and the length of the hole in the drawing die will cause the stock to stretch more or less, as the case may be.

DIE MAKER.

Lynn, Mass.

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A Glass Triangle.

Editor American Machinist:

Since Mr. Fulton has brought up the matter of triangles again, and since also reading your editorial in the same issue (October 20), in which you urge readers to contribute any ideas which they may think will interest others, I beg to submit the following:

I needed a transparent triangle so I made one of glass. I took an obsolete photograph negative—these plates are made of a very superior quality of glass—and cut the triangle as near as possible, then ground the edges correctly on a lap wheel, chamfering the corners. I then washed the film off with hot water. I have used it about three years and prefer it to celluloid. GEO. C. TOWLE.

Lancaster, Pa.

For Simpler Lathes.

Editor American Machinist:

There are signs that one of these days —and the time does not appear to be so very distant—a reaction will take place as to the present complicated designs of engine lathes, and the lathe of the future is more than likely to be one that will more nearly embody the idea of a lathe and not endeavor to be a whole machine shop on one set of legs. The tendency of the past few years has been to add to the so-called "features" of a lathe—to complicate its mechanism, to multiply its parts, to increase its cost to such a multitudinous extent that "its own mother wouldn't know it."

Ten or a dozen years ago a medium sized lathe that would cut right and left hand threads from one to twenty to the inch, that had three changes of feed, eight changes of speed, a device in the head for reversing the feed, a set-over tailstock, and a taper-turning attachment was considered as having quite as wide a range of adaptability for the usual work of a machine shop, or even of the tool-room, as was necessary. But now one manufacturer builds a lathe that has ten speeds instead of eight; another "goes him one better," and puts a lathe on the market that cuts right and left hand threads all the way from one to one hundred or thereabouts; not to be outdone, another manufacturer "bobs up serenely" with a lathe that will feed all the way from five to five hundred to the inch. The next one astonishes us with a machine that will do all the others have done without removing a gear; that has an automatic stop for the lateral feed in both directions—that has a compound rest with power feed in all directions, a power feed to the tail spindle, a taper turning attachment graduated to degrees on one end and thirty-seconds of an inch on the other; a micrometer attachment on the cross feed, a set-over tailstock similarly graduated, the tail spindle graduated in parts of an inch; an automatic arrangement by which the lead screw feed and rod feed cannot be both engaged at the same time, the back gears protected so that you cannot get your fingers caught in them, and generally warranted to be "fool proof," and a little machine shop all by itself. It is just possible that all of these "features" may not be found in one individual lathe, but all of them, and several more, are paraded as "talking points" of the up-to-date lathe.

The natural query that is apt to suggest itself is: Where is all this going to stop? What is the lathe of the future going to be, anyway A tool-room lathe should be not only strong, heavy, rigid and accurate, but so designed and constructed as to be well adapted to all the various jobs that the tool-maker will be likely to be called upon to do on it. Naturally it will be a high-priced machine on this account. But in the every-day routine of a manufacturing establishment, wherein each machine has its allotted work to do, with little variation in its general form or kind, is it necessary or advisable to use lathes with all the "modern features" so liberally advertised, and to oblige the manufacturer who buys them to pay for much complicated construction that is of no use to him? Is it wise for the gentlemen who have charge of a manufacturing plant to urge the capitalist to purchase under the same conditions?

There is no desire to detract from the ingenuity and mechanical skill that have been displayed in the design and construction of "the lathe of the period," for in many cases it has brought out mechanical talent of a high order; but in view of the fact that the duties of the workmen are so divided up and classified that each man has as few different things to do as possible, whereby efficiency, as measured by good work and a large quantity of it, is attained, may it not also be true that manufacturing machines may profitably be considered in a similar light, and the lathe, for instance, be made of a much simpler construction—the parts stronger and better able to stand hard and continued usage, while the entire weight of the machine is reduced, the price considerably lessened, and *for the purposes for which it is intended* a more efficient machine is produced? It is, of course, true that much of the work formerly done on engine lathes is now produced on other machines especially designed for it, but it is also true that there are very many lathes in use for purely manufacturing purposes for which a plain lathe would be equally good, and in many cases even better.

I am aware that this may not be a popular view of the lathe subject, but I believe that there will yet be a reaction from the present complicated and elaborate design of lathes when built for manufacturing purposes, and that the lathe of the future will be a much more simple machine than the present.

OSCAR E. PERRIGO.

New Haven, Conn.

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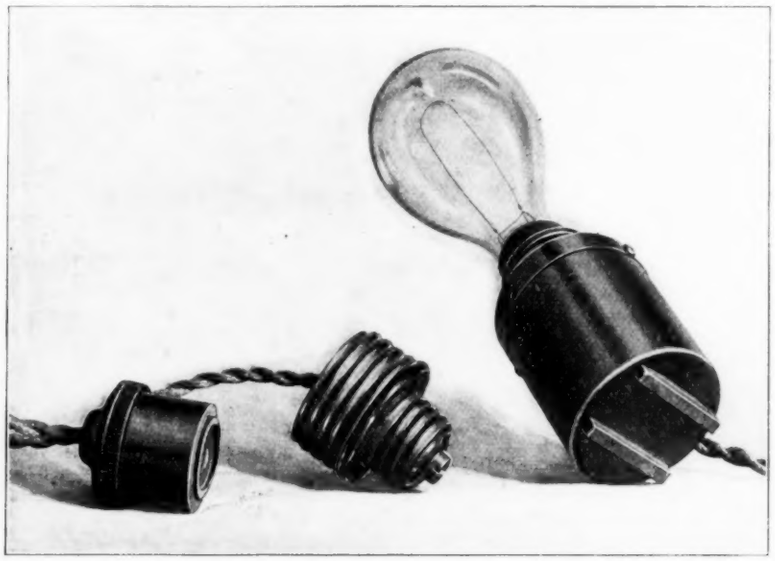
Magnetic Lamp Holder.

We illustrate herewith one of those combinations of old elements which, when made, is so obvious and so very useful that one involuntarily asks why it was not made before.

The elements here combined are an electric lamp, an electric current, and an electro magnet. The properties of these things are in everybody's mind, but it has remained for the inventor of this device to see that by combining them he could make a lamp which would adhere to any piece of iron, the utility of which in a machine shop does not need explanation.



MAGNETIC LAMP HOLDER.

Projecting from the end of the socket nearest the reader will be seen the two poles of an electro magnet. The coils through which this magnet is energized are within the base, the lamp current supplying the energy in passing through these coils on its way to the lamp. The result is that whenever the end of the socket is applied to a piece of iron—the carriage of a lathe, the tool box of a planer, the inside of a boiler, an engine frame in a dark corner, the hull, beams, deck or stanchions of a ship, or any other place where darkness prevails and where machine work is done, the lamp will adhere there, and this whether right side up, wrong side up or any other side up.

The lamp bulb is not a fixture with the

socket, but is simply removed from the nearest convenient fixture into which one of the screw sockets shown at the left and connected by a cable with the magnetic socket is inserted, while the lamp is inserted in the magnetic holder. The device may thus be used anywhere in a shop where electric service is laid on.

The device is of such obvious utility that it gives us pleasure to call attention to it. It is supplied by Jenkins Brothers, of 71 John street, this city.

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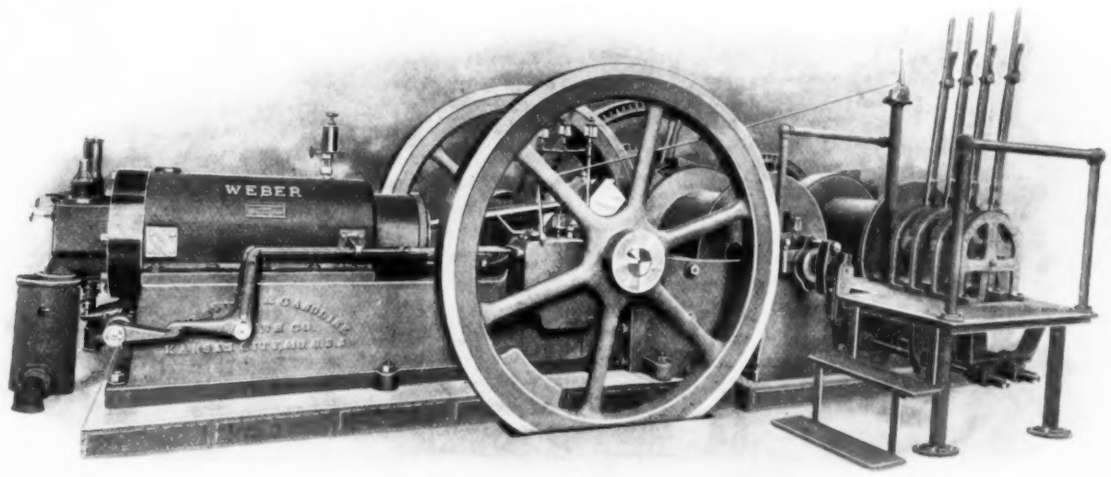
The Largest Gasoline Hoisting Engine.

The half-tone shows what is believed to be the largest gasoline hoisting engine in the world. It was built for the Minas de Santa Maria de La Paz, Matehuala, Mexico, and is now running there in a tunnel in the mine, operating two cages in a double compartment shaft with a lift of nearly 1,400 feet. As Mexico is one of the metric countries the duty of the engine is stated in metric measures, and, as so stated, it is the lifting of 15 metric tons (33,000 pounds) 400 meters (1,312 feet) per hour by each drum.



THE LARGEST GASOLINE HOISTING ENGINE.

The base of the machine, it will be noted, is made in two pieces, not only for convenience in casting, but also to make it possible to place it in the required position in the mine. The measure over all is 17 feet 6 inches by 9 feet 6 inches, and the total weight is 25,000 pounds. It is not necessary to speak of the engine, which is of the familiar four cycle type, with either tube or electric igniter, or, in fact, being provided with both. The cylinder is 15 inches diameter by 22 inches stroke, and the engine in the running speed between the loads and is found to be an important feature.

This engine, by actual tests made before shipment, ran continuously for ten hours at 100 revolutions per minute, with a consumption of six gallons of 74 degree gasoline. It developed 48 brake horse-power on a continuous run of ten hours, with a consumption of 48 gallons, while with 24.3 brake horse-power on a run of the same duration the consumption was 29 gallons, these tests bringing out the fact, in which the engines of this type are unique, that the consumption of gasoline or gas is nearly directly proportioned to the work done.

The tank system of water circulation for cylinder jacket and valve chambers is employed in connection with this hoisting engine, and with a continuous 40 horse-power load the evaporation of water was 22 gallons for the day's run and over night. In the location where this hoist is employed water is very scarce and costly, so that this slight water consumption enables this engine to work where it would be impossible to operate a steam engine. The engine is built by the Weber Gas & Gasoline Company, Kansas City, Mo.

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The Franklin Institute, of Philadelphia, has organized a "Mechanical and Engineering section," which will give special attention to the matters indicated by its title. Very many well-known engineers and mechanicians are interested in the new department, and full information regarding membership, etc., may be obtained by addressing the secretary.

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Mr. Samuel M. Vauclain, superintendent of the Baldwin Locomotive Works, and designer of the Vauclain compound locomotive, addressed the students of Purdue University, LaFayette, Ind., on Saturday, November 12. His subject was "Compound Locomotive." Among other things Mr. Vauclain showed how closely the service tests which he had made on Vauclain compound locomotives agreed with tests made at Purdue.

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The sand blast was used with perfect satisfaction for cleaning the burnt walls of Pardee Hall, Lafayette College. The pointing between the stones was cut away, but as this had been cracked and loosened by the fire, this also was a desirable result rather than otherwise.

AMERICAN MACHINIST

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New Location of the "American Machinist."

The office of the "American Machinist" has been removed to 218 William street, New York. This removal became necessary by reason of the imperative demand for more space in which to carry on the business—space which was not obtainable in our former location. In our new place we occupy the entire fourteenth floor of a new building just north of the East River Bridge and east of City Hall Park, and all the work of producing the paper—typesetting, printing and making of engravings—is now to be done on the same floor. Particulars will be given later, and for the present it is sufficient to say that the new move means a long step forward for the paper and that by reason of it we shall be much better equipped than ever before for carrying on the work.

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American and English Boiler Practice.

The "Mechanical Engineer," of Manchester, England, in its issue for November 5 publishes the provisional standard specifications of the American Boiler Manufacturers' Association, and on them bases some comparisons between American and English practice in the construction of boilers, these comparisons being unfavorable to American practice.

The conclusions of our contemporary are, we believe, sound and beyond controversy. American practice in boiler construction is probably less creditable than in almost any other field of mechanical work, and no one can be properly informed regarding the practice of the two countries without feeling that our own suffers in a comparison between them.

Our contemporary is especially severe on our practice of punching the rivet holes—a practice which is so common here that we sometimes forget that there are others who never use it—never, that is, in work that is considered first-class. Regarding this and other matters our contemporary quite justly remarks:

"Any engineer, however familiar with good English boiler work and methods of construction, must feel, on perusing the standard set forth by American makers, that it permits, and in a measure officially recognizes, methods and practices which no first-rate maker on this side would care to defend."

If the matter were sifted to the bottom we have little doubt that the difference in practice would be found to be the outgrowth of differences in conditions rather than an inherent desire for better work on the part of English boiler makers. The almost universal use here of comparatively small externally fired boilers, and the equally common use in England of the large internally fired type, account, we believe, in large measure for the difference in practice in drilling and punching the rivet holes. Our small shells call for comparatively thin plates, while the English boilers, with their large shells, require correspondingly thick plates, and it is obvious enough that methods which would produce at least tolerable work with thin plates could scarcely be used at all with thick ones; while on the other hand, with the means for drilling the holes in place provided, for use in making large shells, it would be but natural to use the same methods when boilers of the type used here are called for, which indeed customers educated in the use of drilled holes would insist upon, and it has thus come about that the type of boiler which is characteristic of American practice is better made in England than here.

At the same time we do not believe that the real difference in the quality of the boilers made in the two countries is as great as English engineers think. The comparison is, in a measure, similar to that between the two countries in regard to the use of cut and cast gearing. It is hard for an American to consider the use of small cast gearing in anything but machinery of a rough character, its use in machine tools, for example, being considered as a relic of barbarism. While, however, we justly regard cast gearing as essentially inferior, it is nevertheless a fact that the more common use of cast gearing in England has led to the development of methods of manufacture there by which such gears are made, which, while of course not equal in the average case to the average of cut gearing, are nevertheless far superior to the quality which we instinctively associate with cast gearing. It is, we believe, much the same with our punched boiler work. The practically universal use of punched work here has led to a development of methods which produce work which is as much superior to the English conception of such work as their cast gearing is superior to our conception of such gearing. In fact, we have no doubt that the editor of the "Mechanical Engineer," however much he might disapprove of the process, would be surprised at the perfection with which punched seams are made to match in our best boiler shops.

In saying this we would not be understood as apologizing for, or approving of, punched work. It is at best inferior, and can only be defended by the argument that it "is good enough"—an argument that can be made to defend any practice, no matter how bad—while the splendid workmanship of English boilers, whatever may have been the original reason for its adoption, deserves to be recognized and to have all due credit given for it.

The above remarks are intended to apply to the ordinary American stationary shell boiler. They certainly do not apply to our locomotive boilers, which in these particulars are far superior to our stationary shell boilers. Possibly they are so made because they have to be, but the fact is undoubted that our locomotive boilers are fair representatives of all that is best of the boiler maker's art; and in saying this we have not forgotten the English practice of using copper fire boxes—a practice which we believe to accomplish no other purpose than the spending of an unnecessary amount of money.

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Simpler Lathes.

Elsewhere in this issue we print a letter in which the author of it predicts a reaction toward simplicity in lathe construction. As an expression of opinion by one who has given the matter considerable attention it is worthy of note, but we do not look for such a movement as is predicted by him. The fact is, that where a man is sure he is going to do nothing but manufacturing operations on a lathe—that is, to turn certain pieces of work in large numbers—lathes of very plain and simple construction can now, as always, be obtained for that purpose. But lathes are proportionately less and less used in strictly manufacturing operations. The turret machine alone or in conjunction with the grinding machine, is doing a large share of the manufactur-

ing work formerly done by the lathe, and the proportion of work so done is constantly increasing, leaving for the lathe only that work in which comparatively few pieces alike are to be made. And on such work the necessary changes of feed rate and of lead-screw motion cannot be too much facilitated within reasonable bounds.

We shall shortly publish a full account of a new lathe which goes still further in the direction of new functions, and we think it is an excellent lathe.

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The Annual Meeting of the American Society of Mechanical Engineers.

The official program for the fall meeting of the American Society of Mechanical Engineers, to be held in this city from November 29 to December 2 inclusive, gives the following list of papers to be read at the meeting:

Mansfield, A. K. Note on Strength of Wheel Rims.

Benjamin, C. H. The Bursting of Small Cast Iron Fly-Wheels.

Vail, J. H. Cooling Tower and Condenser Installation.

Kerr, C. V. Theory of the Moment of Inertia.

Le Van, W. B. Improvements in Steam Boilers.

Norris, R. Van A. Generation and Utilization of Steam by the Lykens Valley Coal Company.

Svenson, John A. F. Valve Gear of the Willans Engine.

Jacobus, D. S. Methods of Testing Indicators. Aldrich, W. S. Variations of Belt Tensions with Power Transmitted.

Hale, R. S. Calorific Power of Weathered Coals.

Bryan, W. H. Mechanical Plant of a Modern Commercial Building.

Carpenter, R. C. Specific Heat of Superheated Steam.

Carpenter, R. C. Experiments on the Flow of Steam Through Pipes.

At various times during the meeting the following queries will be taken up for discussion:

Does it pay to pickle ordinary castings?

Has any improvement in foundry practice been observed from the recent investigations into the physics of cast iron?

What is the strength of pipe fittings made by a casting process?

What constitutes a seamless tube?

On how small a tool does it pay to put an individual electric motor?

Have you any new notions on machine shop floors?

Is it of real advantage to submerge the smoke box of an upright boiler to prevent expansion of the tubes?

The annual address of the retiring president is slated for the evening of November 29.

Personal.

Mr. George H. Swift, late with the Brown & Sharpe Manufacturing Company, is now representing the E. A. Kinsey Company, of Cincinnati.

William A. Box, who was formerly chief draftsman for Alfred Box & Co., Philadelphia, Pa., has been appointed chief draftsman and assistant superintendent of the Denver Engineering Works Company, Denver, Col.

Mr. P. G. March, formerly of the Cincinnati Universal Radial Drill Company, has with S. W. Skinner organized the Cincinnati Shaper Company, and they are fitting up the premises formerly ocupied by the G. A. Gray Company, in Cincinnati.

W. C. Ennis, for twenty years master mechanic and car builder of the New York, Susquehanna & Western Railroad, has connected himself with the Chicago Pneumatic Tool Company, and will travel from the New York office of that company.

Mr. A. C. Christensen, consulting engineer, of 141 Broadway, N. Y., recently returned to this country after a visit of several months to China, where he has been engaged in the design and construction of a water works plant for the city of Shanghai.

Messrs. W. H. Burtner and B. B. Quillen, late vice-president and secretary respectively of the American Tool Works Company, have organized the Cincinnati Planer Company, and are erecting a shop at Harrison avenue and Buck street, Cincinnati, 120 feet long by 80 feet wide, which they expect to occupy about January 1.

Our contributor Mr. Henry Hess, who left this country for Germany about five months ago to be engaged on work in connection with the new Deutsche Niles Wergzeug-Maschinen-Fabrik, at Berlin, has recently returned to America. He will be located at the Niles Tool Works, Hamilton, Ohio, until spring, when he will return permanently to Germany.

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The End of the Keely Motor.

John Worrell Keely died in Philadelphia November 18, seventy-one years old. Not much is known of his early life. He burst into notoriety in 1873 as the alleged discoverer of a new means of power development, by means of which, as he claimed, power in unlimited quantity could be obtained at little or no cost. A company was formed and Keely was supplied with funds to develop the invention. In 1874 he gave exhibitions in his workshop. A committee of the Franklin Institute witnessed some of his experiments, but were permitted to see nothing of the means by which certain results were accomplished. Pipes were burst, weights were lifted apparently by the disintegration of a few drops of water; weights seemed to float in water, to rise and fall at the will of Mr. Keely upon his sounding a chord on a jew's harp. The shares of the Keely Motor Company mounted rapidly and were dealt in in the principal cities of the Union. Keely from time to time announced new features of his discovery, but never got ready to apply for patents. Dissensions arose between him and the Keely Motor Company. His bills were not paid and he was practically abandoned by the company.

About this time a Mrs. Moore, a wealthy lady, formerly of Philadelphia, gave him the means to continue his investigations, and soon after he announced a new discovery, and proposed to abandon the first for the second, which precipitated a lawsuit against him by the original company. In connection with this Keely was committed to prison for contempt of court in refusing to divulge secrets pertaining to his invention. During the next eight or ten years several public experiments were made by Mr. Keely, one in 1887 at Fort Lafayette for the United States Government.

The principle of the new discovery, so far as announced by Mr. Keely, was based upon an intermolecular vibration of the ether, to which he gave the name "apergy." He claimed that there was a perpetual flow of vibrations through space, polar and depolar, or positive and negative, and that it was only necessary to produce a machine which would respond to these vibrations to secure the power. The apparatus which he constructed he claimed to put in harmony with this flow by sounding on some instrument a "chord of mass," and for this he used jew's-harps, triangles, mouth organs, tuning forks, harps and other musical instruments.

About three years ago Mrs. Moore permitted two gentlemen well qualified to express an intelligent opinion to see Mr. Keely's latest experiments and to listen to his explanations. They reported to Mrs. Moore that they saw nothing which could not be explained by well-known physical laws, and that in several instances they had demonstrated that they were so produced. Professor Lascelles-Scott, of London, soon after this spent a month in Philadelphia in association with Mr. Keely, and announced at a Franklin Institute meeting that Keely had certainly discovered a new force. One of the gentlemen before referred to was asked to visit the laboratory in the presence of the professor and Mrs. Moore, that he might be convinced. He spent the afternoon there and then spent the evening with the professor, on which occasion the professor was enlightened upon some points and left the city within forty-eight hours. He did not return to give a promised second lecture before the Franklin Institute. Mrs. Moore the next day announced in the evening papers

that the agreement to furnish Mr. Keely with funds had been abrogated.

Since then Mr. Keely has been engaged in the construction of an engine which he claimed would develop 60 horse-power, although in none of his experiments had he ever given any exhibition of operative power by continuously driving anything. It is also stated that complete specifications of the alleged invention to be embodied in applications for patents have been prepared.

Keely was supplied with sufficient funds to enable him to live comfortably for fifteen years, which is the only actual result accomplished by his performances, which have had throughout all the characteristics of imposture.

The stockholders of the Keely Motor Company number, it is said, more than 3,000, and the history of the Keely motor up to date is a history of succcessful imposition upon the credulity of the capitalist without scientific knowledge. We do not believe that any secret of value is buried in Keely's grave, or that the world would have been practically richer if he could have gone on indefinitely in the course which he had followed since he first attracted the attention of the public. Most of the brief sketch here given of his career is abstracted from an interesting account in the Philadelphia "Ledger" of November 19.

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Death of Joshua Rose.

Joshua Rose, the well-known writer upon tools and shop practice, died in a hotel in this city November 14, sixty-one years old. He had, as is generally known, resided in England for several years past, and had been in this country for a few months engaged in the preparation of a new and improved edition of his "Modern Machine Shop Practice." To bring this work up to date involved a vast amount of labor, and, as his health since his retirement from steady employment had not been good the exertion required proved too much for his enfeebled constitution. Although Mr. Rose was born in England and the pecuniary results of his labors had enabled him to retire to a permanent English home, his reputation was an American product, and his life work may be said to have been done here. His father, according to his own statements, had a shop in England, and he there learned the machinist trade. In this country he was a journeyman machinist, and of not sufficiently pronounced value as such to permanently attach him to any one establishment. He worked in many shops and his circumstances were none too good, even for a wandering "jour." He worked for a considerable time at the Freeland Tool Works, in this city, which may almost be said to have been a quarter of a century ago, or somewhat further back, *the* tool works of the United States. The most pronounced possession of Mr. Rose was probably his ready and copious command of language. Volubility, whether in writing or in his conversation, was always noticed by those who had to do with him. Accordingly, while working in New York, this volubility found employment in channels far from mechanical. He was writer for and perhaps the most prolific writer in "Woodhull & Claflin's Weekly," when that notorious publication was most notorious. He wrote editorials and other matter, and also a continued story or novelette. It was this volubility which also carried him along when he began to write upon mechanical subjects. His contributions began to appear in the technical and pseudo-technical publications of the early seventies. He was an omnivorous collector of material and industrious in putting it into attractive shape. He had not the sense of proportion that a greater mechanic must inevitably have betrayed. He wrote minutely and copiously of shop operations and appliances, but he wrote of the most trivial and unimportant details with the same careful minuteness that he accorded to the most responsible and really important. He was not suggestive of the better methods which have developed so rapidly in recent years, but he undoubtedly rendered a service in bringing the many to know what a fewer number would have known without his services. He had attained such a reputation by his writings in the periodicals that he was engaged as one of the collaborators in the preparation of Appleton's Cyclopedia of Applied Mechanics, which was published in 1878. "Rose's Complete Practical Machinist" appeared in 1880, and "The Slide Valve Practically Explained" appeared the same year. "Modern Steam Engines" was published in 1886, "Steam Boilers" in 1888, and "The Pattern-Maker's Assistant" in 1889. His "Modern Machine Shop Practice" was, however, his great work. This, in two quarto volumes, with nearly a thousand pages of text and more than three thousand engravings, involved a vast amount of labor in its preparation. It had an extensive sale, and the income derived from this and Mr. Rose's other books, all of which we have not enumerated, had enabled him to retire from active life with a sufficient provision for his latter days. It was his conviction, however, which the result seems to have proved correct, that it would have been better both for his health and happiness if he had continued in the harness.

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Obituary.

Leighton Lee died in Chicago November 14. He was for many years connected with the Pusey & Jones Company, Wilmington, Del., and later was chief assistant to Mr. Edwin S. Cramp, of the shipbuilding firm of that name.

Edwin A. Kimball, an inventor and mechanical expert, and formerly superintendent of the mechanical department of the University of Illinois and the Industrial Home for the Blind, in Chicago, died in that city November 15, sixty-four years old.

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Commercial Review.

NEW YORK, SATURDAY EVENING, Nov. 19, 1898.

ENGINES AND BOILERS.

Four weeks ago, in reviewing this department of the machinery market, we said that business showed a better tone and was very comfortable. Speaking of the engine and boiler trade of this autumn as a whole we desire to reiterate that statement and to make it trebly emphatic. Now that the hight of the season is naturally past and begins to appear in perspective one realizes the magnitude of the business that has been done. Not only has trade been wholesome, but it has been so much more active than in times preceding as to show clearly that the country is approaching such a state of prosperity as existed before the depression of '93. The experiences of some companies even go ahead of this. Says the representative of one high grade engine firm: "At no time since '88 has business, as we see it, been as brisk as it is at present; '91 and '92 did not begin to compare with this season. Furthermore, the customers that are in the market now are all responsible people. They do not invest without the money behind them, and capital is abundant. Commercial paper is very active. Among the types of engines conspicuously in demand are large units for electric railways. Manufactories are buying freely, notable among them being the steel mills and paper mills. Our business has continued to improve right up to date." One of the largest and oldest boiler companies in the country, we are informed, surpassed last year's entire sales in the first six months of this year. Its trade has held steady through the season, and this year will be the biggest in its history. "We are getting back to the old basis of business," observes the manager of another boiler office.

As between engines and boilers, the greater activity seems to be with the boilers, perhaps because of less competition. If anyone questions whether the latter part of '98 has been a good business season let him ask almost any one of the leading boiler companies represented in this market.

To the withholding of contracts at the time of the war and the subsequent relaxation of business anxiety, the activity which characterized the months of Sep-

tember and October is largely attributable. The prospects for the coming year are very bright indeed. We do not say that at the present moment engine and boiler sales are as many as they have been. Those trades are not so much under the influence of seasons as some others, but they are affected thereby more or less, and just now, when arrangements for the winter have already been made, when the holidays are in prospect and it is too early to think about spring, orders naturally slacken. Many sellers, therefore, report less contracts of late than they have received previously. Some, however, do not notice any such slackening in demand.

What we say in regard to the market must not be taken as applying too strictly to that of New York city. Conditions here are less favorable than at some other points. Some manufacturers' representatives tell us that they find local trade discouraging, but that the factories they represent are crowded with work from the West. The demand for engines for isolated lighting plants here does not seem to be very active this season, at least not for office buildings, of which so many new ones have been put up in late years. The steel mills around Pittsburg constitute one of the most lively classes of customers. It may be mentioned that the Shoenberger Steel Company has bought from McIntosh, Seymour & Co. an 18x36x24 (600 horse-power) vertical cross-compound engine, to be direct-connected to a 400-kilowatt Westinghouse generator, for power purposes.

Cement mills are also buying. One was in the market the other day for 750 horse-power of boilers, and no doubt has secured them. The name was not told us, but it may have been the International Cement Company, which, it is rumored, was looking for a plant of about that description. For the Alpha Cement Company have been ordered about 1,000 horse-power of American Wheelock engines. Shipment of three 800 horse-power engines of the same make, intended for lighting purposes, to J. G. White & Co., New York, is just commencing.

For the plant of the New Jersey Zinc Company, of Pennsylvania, which is one of the plums of the season, are being constructed three Payne engines aggregating 650 horse-power. The outfit also includes some big engines, supposed to be for blowing purposes, which, we learn indirectly, will be put in by the Dickson Manufacturing Company, Scranton, Pa

The manager of the Boston office of a certain company, who was in New York yesterday, while commenting upon the affairs of the New England textile mills, said that many in Fall River and along the Sound were in very hard straits, while those farther north, in Massachusetts, for instance, were enjoying relative prosperity.

Speaking of foreign trade, one engine company reports improved demand from Germany; another, good inquiry from South Africa, China and Japan. Offers to take the Cuban and Porto Rican representation of companies are numerous, but the actual demand from those islands for engines and boilers is not regarded very seriously as yet. The Abendroth & Root Manufacturing Company has of late severally sold three large boilers for mining purposes in Mexico.

The Albany Boiler Works have on hand, exclusive of their boiler contracts, orders for fifty-six tanks.

Among its orders taken through the New York office, the Harrisburg Foundry & Machine Company has on hand a contract for three 100 horse-power double direct-connected engines for a new passenger station of the N. Y., N. H. & H. R. R., at Providence, R. I.

A BOOM IN PAPER.

Not on paper, but in paper. Of all lines of manufacture from which engine and boiler contracts are now emanating this appears the most worthy of comment as a market feature. One of the best engine contracts of any kind let within the last few weeks was given out by the New York & Pennsylvania Company, Johnsonburg, Pa., manufacturers of pulp and paper, who are doubling the capacity of their plant. It calls for 2,875 horse-power of Wetherill-Corliss engines. Fifteen 78 inches by 20 feet boilers were purchased by them from McEwen Brothers, Wellsville, N. Y. The Pusey & Jones Company, Wilmington, Del., has just ordered two 400 horse-power American Wheelock engines for paper mill work. The Watertown Steam Engine Company is said to have on hand orders for over 1,000 horse-power of engines for like purpose. Another engine company reports several inquiries, domestic and foreign, of the same nature. The Heine Safety Boiler Company's late business through its Boston office has consisted notably of sales to paper and pulp mills.

MISCELLANEOUS.

A fiber box company, Chicago, Ill., has purchased several 1,000 horse-power and one 4,000 horse-power Hoadley-Knight compound wind system rope drives. The International Air Power Company has just ordered Hoadley-Knight air compressors and compressed air street car equipments—the number not yet definitely settled—for shipment to Tokio, Japan. The terminal pressure will be 4,000 pounds per square inch.

The Fifield Tool Company is crowded with work on large lathes. It has just shipped to parties in Pennsylvania a 42-inch lathe with a 44-foot bed which is composed of a single casting. This machine will be used on gun work.

Several new machine tool companies are entering the field of manufacture in Cincinnati. One of these is the Cincinnati Shaper Company, which has taken the buildings on Sycamore and Webster streets, formerly occupied by the G. A. Gray Company. Another is the Cincinnati Planer Company, which includes in its official personnel some men formerly connected with the Davis & Egan Company. The foundation of a company to manufacture drilling machines is also currently rumored. For several weeks reports have been circulating among machine tool men that the agency in New York city of the Putnam Machine Company, hitherto with the Prentiss Tool & Supply Company, was to be placed with Manning, Maxwell and Moore. This appears to be correct as respects their metal-working machinery. The impression may have existed that the same is true of the Fifield Tool Company, but we are reliably informed that this is not the case. We do not attempt to say whether Manning, Maxwell & Moore are selling any of their tools.

CINCINNATI REPORT.

The record of the iron and steel trades, both in raw and finished material, for the first ten months of this year is very satisfactory. Orders were principally for small amounts, but they were numerous. The advance in the price of Southern pig iron from its lowest point in midsummer is for the various grades about $1 per ton. Consumers who desisted from buying after the advance, expecting a reaction, will find that they must pay the price asked. Furnace men consider the conditions favorable for a further increase in price ere the year ends. On large sales made months ago the iron is not yet all delivered and scarcity of cars prevents ready shipment. Many producers have all the orders that they can take care of for the rest of the year or longer.

Much activity is still found in the machinery, machine tool and engine trades. The signs indicate no falling off of demand. The increased business of some of our manufacturers has created a necessity for greater facilities, and besides the up-to-date plants that have lately been built, others are projected. It looks as if the building spurt of this year would be repeated next year. Certain parties now in the manufacture of wood-working machinery are thinking of adding machine tools to their line of work. The greater prosperity of the latter branch of industry is a reason for this. How largely the project will be carried out depends upon the success coming to them in the initial venture.

Following is a résumé of business news that we have gathered among local manufacturers: The Bickford Drill & Tool Company's October business was the best on record for that month of the year. Thirty radial drills were sold during the month for export. Among twelve of the largest sized tools made for

this country were two for the navy yard at Washington, D. C. The machines ordered keep the shops working nights, and prospects are exceedingly bright. The October trade of the American Tool Works Company kept up very well indeed. They are making a shipment to Mitsue & Co., Yokohama, Japan, amounting to $15,000. The Bradford Mill Company's business has been continually on the increase of late, with a good volume of export orders received and a fair amount of home trade. They are kept very busy, with a full complement of men, and are working twelve hours per day. The Cincinnati Milling Machine Company's orders this fall have been good, although the rush of them has fallen off a little. They have a considerable number on their books to be filled, a large proportion of them being for export, though a fair amount of trade is domestic. Dreses, Mueller & Co. have continued busy through the fall. The larger part of their sales has been for foreign account, though domestic orders have been good also. They have many contracts on their books yet unfulfilled. Dietz, Schumacher & Boye's trade is also good still. In their case, too, the foreign market seems now to be the more important factor, though some time ago it was about evenly matched with the home market. The Lunkenheimer Company, in the last two months, has found much increase in orders received. This applies not only to their home but to export trade. They have a large number of men at work on full time. The increased demands are such that they have secured a location, and in the coming months will erect a large and complete plant of the most modern arrangement, with good sized rooms, good light and all conveniences. The J. A. Fay & Egan Company finds trade throughout the country rapidly approaching good times so far as their business furnishes a criterion. It has steadily increased for six months past. They are working to full capacity. Many old wood-working mills are buying new machinery to compete with others recently fitted up. In the past eighteen months this company has done a good deal in the way of introducing new and improved types of wood-working machinery. Houston, Stanwood & Gamble report that business still continues remarkably good. They have many orders for engines on their books, including contracts from lumber companies in Florida, Georgia and Wisconsin. Orders have come for several engines to go to Mexico, South America, Russia and other foreign lands. Many inquiries arrive from the South and West, and the outlook for future trade is very bright. J. H. McGowan & Co. find that their business has kept up very well for the last ten months, and they have received more orders than in the same time last year. They have filled a good number of contracts for large pumps of from 1,500,000 to 5,000,000 gallons per day for waterworks plants. The Sebastian Lathe Company's business continues good in number of orders received for home and export trade. The Cincinnati agent of the Buckeye Engine Company notes increased activity in this territory. The company has orders, among others, for some 1,500 horse-power engines. A double turn of men is kept hard at work. Good sales of Stirling water tube boilers were made during October. The sales in this market of the Keasbey & Mattison Company, Ambler, Pa., comprising boiler and pipe coverings, were excellent. Its business in this section for the first ten months of this year showed an increase of 25 per cent. over the corresponding portion of 1897. Next year bids fair to outdo the present.

CHICAGO MACHINERY MARKET.

The demand for engines is greater than ever before is the verdict of builders who construct Corliss and other high power engines. Trade is reasonably active, but is not what it should be, say the builders of small sizes. The two statements seem to differentiate the market into two well defined classes, and to continue conditions that have been apparent for several months. One recent transaction at Chicago has been the equipment of a central power plant at the stock yards of P. D. Armour & Co. Last week the Brass Foundry & Machine Company, of Fort Wayne, took the contract to furnish a 1,700 horse-power engine for this plant. The company is negotiating for additional power to bring the total up to about 3,500 horse-power. This central power will supersede the present motive power scattered through the works. Armour & Co. are also negotiating for about 3,000 horse-power with which to equip two large elevators on the Burlington road near Chicago, one of which was recently burned and is being rebuilt. Wicks Brothers, of Saginaw, Mich., have sold to Armour & Co. boilers to the capacity of about 6,000 horse-power for the equipment of the stock yards plant and the elevators. But street railway work continues to form the bulk of trade in high power engines, and the demand is so great that makers are not gaining a day

(*Continued on page 39.*)

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Business Specials.

Gear wheels, gear cutting, Grant; see page 18.

Forming Lathes. Mer. Mach. Tool Co. Meriden, Conn.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

Export to Europe—General agency for own account for sale of machine tools and hardware wanted by Neumann & Boeler, Hamburg, Germany.

For Sale or Rent—Foundry and machine shop with additional land, in good condition and well equipped for medium heavy work; capacity of foundry 7 tons per day; located on railroad within eight miles of New York; terms easy. Call or address J. F. Sweasy, 26 Nassau street, New York.

A manufacturing concern having large shops with modern tools, foundry, pattern shop, etc., is desirous of adding to its present line, and wishes to negotiate with parties wanting mach'y. built. Box 36 AM. MA.

Complete set American Machinists, 1877 to 1898, for sale; first 18 vols. bound in morocco, uniform in style (binding alone cost $4.75 per vol.); 1896 vol. 19 in cloth; 1897 vol. 20 includes advertising, and is in leather; 19 volumes have name of private individual on side; will sell the twenty volumes complete for $100. Address Volumes, care AMERICAN MACHINIST.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Foundry foreman of 20 years' experience wants to make a change. Box 120, AMERICAN MACHINIST.

Mechanical draftsman, shop and drawing room experience, desires to change. Box 118, AM. MACHINIST.

Wanted—Position as machinist on general repairs; capable of taking charge; age 35. Box 112, AMERICAN MACHINIST.

Wanted—A steady position by an experienced Jones & Lamson machine hand; also a good general machinist. Apply Box 110, AMERICAN MACHINIST.

Wanted—Position as manager or superintendent of foundry and machine shop, by a man of ability and exp. Best of references. Box 105, AM. MACHINIST.

Position as foreman or supt. on light, fine mfg.; 20 years' experience in design and construction; best references. Address Box 123, AMERICAN MACHINIST.

Draftsman and mechanical engineer, 20 years' varied experience; practical designer of high grade engines, tools, etc., desires situation. Box 23, AM. MACHINIST.

Wanted—Position as foreman; had experience on small tools, model gauge, die and small machinery; smaller the better; good reference Box 89, AM. MACH.

Mechanical draftsman, technical graduate, wants pos.; shop practice; 7 yrs.' exp as dr'fs'n, gen. mach'y, rolling mill mach'y and structural. Box 111, AM. MACH.

An experienced machinist and draftsman desires a position as foreman or master mechanic; is used to managing men and can furnish best of references. Box 94, AMERICAN MACHINIST.

A successful mechanical supt. is open to engagement; a first-class manager up in modern shop practice on economical production of work; correct habits and reliable. Box 126, AMERICAN MACHIST.

Gas engine draftsman, has very simple valve operating mechanism, cheaply made, no gears, cams, wants to manufacture engine on royalty, with position. Write Automatic Gas Engine, Grand Rapids, Mich.

M. E., first-class dr'f'man; speaks German; 12 yrs. exp. in designing of elect. mach., espc. power and tract. and current controlling apparatus, open for position; best refs. Box 122 AMERICAN MACHINIST.

A practical machinist, thoroughly posted in modern shop practice and economic production, desires position as ass't sup't or foreman; refs. from present employers; will be at liberty Dec. 1. Box 113, AM. MACH.

A young man desires to work at the Paris Exposition before or during the fair; first-class general machinist; understands drawing thoroughly; strictly temperate; can furnish ref as to character and ability. Ad. Chas. W. Vogel, 452 W. Mt. Pleasant, Germantown, Phil.

Wanted—A young electrical and mechanical eng'r at present employed by one of the largest electrical firms in the country, as head dr'ft'n, desires a change; would like a pos. as erecting eng'r or as dr'ft'n and d'sg'r of mach.; can give best of rec. Bx. 119, AM. MACH.

Manager, secretary or representative of manufacturing plant; married man; age 35; 16 years' practical experience in manufacture, purchase and sale of railroad and structural iron and steel, cast iron and brass specialties, office, mill and shop management; unexceptional refs. Address Manager, care of AM MACH.

Help Wanted.

Wanted—An experienced salesman to sell machine tools; must speak German. Address Box 124, AM. MA.

Wanted—First-class machinist familiar with pump work, to take charge of small pump shop as a working foreman. Box 114, AMERICAN MACHINIST.

Wanted—Foreman for machine shop; one accustomed to drafting and handling men on piece work plan; state age, salary expected, etc.; must be an American, with recommendations. Bx. 116, AM. MACH.

Wanted—Machine shop night foreman to handle about 20 men in repair shop connected with large works; all work is of an emergency character; only a hustler wanted; wages $4 per day. Address F. B. Edison, N. J.

Wanted—Boiler shop manager and supt.; one who is thoroughly competent to take charge of a shop employing from 30 to 60 men; is expected to handle sales, estimates, etc.; in applying state exp., refs. and salary expected, also how soon could begin work if engaged. Address Box 125, AMERICAN MACHINIST.

Help Wanted—Continued.

Wanted—Mechanical draftsman accustomed to engine work; state experience and salary. Foos Gas Engine Co., Springfield, Ohio.

Wanted—Working foreman, experienced in making electrical specialties; must be energetic and able to keep things humming. state experience and references. Address Box 115, AMERICAN MACHINIST

Wanted—Foreman blacksmith experienced in machine forging and steel working; shop connected with engine manufacturing concern; New England. State experience, age and pay; give references. Box 99, AMERICAN MACHINIST.

We want a first-class foreman die sinker for a room employing twelve to twenty men; must be able to get out work rapidly and able to retain good men under him; must have ability to follow up his dies and see that they work. Address Box 121, AMERICAN MACHINIST.

Wanted—Foreman for machine shop in city in Canada employing about 30 hands, with up-to-date equipment; one used to general repair work and making of duplicate parts to gage; must be a hustler, able to handle men and turn out first-class work at a low figure. Reply, stating age, experience and remuneration required to P. O. Box 2303, Montreal, Que.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper catalog free. E. G. Smith, Columbia, Pa.

Book, Dies & Die Making, $1. J. L. Lucas, Prov., R. I.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Foundry for sale; centrally located on one of the principal railroads; sell cheap. Box 117, AMERICAN MACHINIST.

Wanted—One heavy shafting lathe 54 in. or 60 in. swing by 25 ft.; second-hand in good condition. The Murray Iron Works Co., Burlington, Ia.

Wanted—Rim gear wheel milling machine; also cam milling machine, second-hand, if in first-class condition. Address Box 98, AMERICAN MACHINIST

Wanted—A good second-hand vertical, boring and turning mill, from 84 in. to 98 in.; give full particulars. Address Geiger, Fiske & Co., Louisville, Ky.

Wanted—Second-hand Corliss engine of 800 to 1,200 horse-power; must be in first-class shape; give full description and price; answer quick. Address A. B. Steffens, 855 The Rookery, Chicago.

Engineers and firemen, send 10 cents for a 24-page pamphlet containing a list of questions asked by an examining board of engineers. George A. Zeller, bookseller, 18 S. Fourth Street, St. Louis, Mo.

Wanted—To contract for the manufacture of fifty special machine tools; the advertiser has patterns and drawings; very high-grade work desired; with capacity of turning out at least six machines per month. Box 95, AMERICAN MACHINIST.

Wanted—To lease in New England or the East an established machine plant suitable for the manufacture of medium and heavy machine tools; give fullest particulars as to plant, naming make of tools and present condition Box 96, AMERICAN MACHINIST.

Institutions retiring from business having machine tools, brass or wood working machinery, will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach Co., 55-59 Woodbridge st., W., Detroit, Mich.

A Belgian eng. who had the management of large establishments and possesses influential connections wishes to represent in Europe mfg. works producing cast iron, steel in blooms, in profile, cons't companies, &c. Address Mr. Lejeune, engineer, Charleroi, Belgium.

An established manufacturing company near New York City wishes to lease its foundry to a practical foundry man; will furnish four to five hund ed dollars' worth of business per month from the start; fine opening for the right man; no agents recognized. Address Box 56, AMERICAN MACHINIST.

The Reid Chuck.

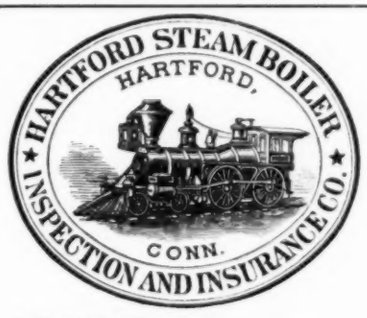
A right chuck at a right price.

R. H. Brown & Co., New Haven, Conn.

NOTICE is hereby given that the Cleveland Gear Works have been leased to W. R. Sawyer, and that the former operator, Geo. B Grant, will not be entitled to the receipts or responsible for the debts of that concern from and after March 1, 1898

OIL FILTERS

THE BURT MFG. CO., Akron, O., U. S. A.



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IN VARIOUS LENGTHS—9 to 15 in. SWING.
Latest and Most Approved Designs. Workmanship, Material and Finish of the Highest Order.

SEBASTIAN LATHE COMPANY,

117 and 119 Culvert Street, CINCINNATI, OHIO, U. S. A.

Agents: SELIG, SONNENTHAL & Co., London, Eng.; JN TRAGARDHOH & Co., Goteborg, Sweden; E. SONNENTHAL, Jr., Berlin, Germany; R. S. STOKVIS & ZONEN, Rotterdam, Holland.

A HAND-BOOK OF ENGINEERING LABORATORY PRACTICE.

By RICHARD ADDISON SMART, M. E., Associate Professor of Experimental Engineering, Purdue University.

viii.+290 Pages, 12mo, Cloth, $2.50. *Order through your bookseller, or copies will be forwarded postpaid by the publishers on the receipt of the retail price.*

JOHN WILEY & SONS, 53 East 10th Street, New York City.

Jenkins Standard '96 Packing

weighs 33⅓ per cent. less than most joint packings, does not Rot, Burn or Blow out, and will last longer, therefore the cheapest and best for all purposes Good buyers compare weights. Genuine stamped like cut.

JENKINS BROS., New York, Boston, Philadelphia, Chicago.

(*Continued from page 38.*)

upon their work, but instead are falling behind steadily. There is a fair amount of business with the general manufacturing trade, but it is mainly with old plants. One of the few new plants now in the market for engines is a chemical works at Toledo, Ohio, which wants four 1,000 horse-power of engines. The power is to be used for driving an electrical plant to decompose matter. Several similar plants have recently been built in Michigan.

In the smaller engine trade there is a scattering demand from the whole range of industrial activity. Coal mines, precious metal mines, lumber camps, manufacturers of all kinds, municipalities, machine shops, etc., are each contributing their quoto to the inquiry and to the purchases that are being made. Second-hand engines are not neglected. Buyers who have tried them at bargain prices are shopping for more of the same. The fall trade in engines began this year a little earlier than usual and is tapering off a little earlier. The year is rounding out with the great majority of sellers doing a quite satisfactory business. With some demand increases; with others it is decreasing. General comment is that inquiries are satisfactory.

The Erie Iron Works are now installing water tube boilers to the capacity of 1,500 horse-power recently sold to the city of Logansport, Ind., for water works and an electrical plant.

The E. P. Allis Company has recently sold one 500 horse-power engine to drive an air compressor in the Michigan copper region and an engine of the same capacity for a large paper factory. The company is compelled to decline more business than it accepts because desired deliveries cannot be made.

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Quotations.

NEW YORK, Monday, Nov. 21.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 25 @ 11 50
No. 2 foundry, Northern	10 75 @ 11 00
No. 2 plain, Northern	10 50 @ 10 75
Gray forge, Northern	10 00 @ 10 25
No. 1 foundry, Southern	11 25 @ 11 50
No. 2 foundry, Southern	11 00 @ 11 25
No. 3 foundry, Southern	10 50 @ 10 75
No. 1 soft, Southern	11 25 @ 11 50
No. 2 soft, Southern	11 00 @ 11 25
Foundry forge, Southern	10 00 @ 10 25

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.05 @ 1.10c.; refined, 1.15 @ 1.20c. Store prices: Common, 1.30 @ 1.35c.; refined, 1.35 @ 1.50c.

Tool Steel—Base Sizes—Standard quality, 6 @ 7c., with lower prices on some brands; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.45 @ 1.55c.

Cold Rolled Steel Shafting—Base sizes, from store, 2.25 and upward, according to brand and quantity. A ruling figure for moderate amounts is 2.31c.

Copper—Carload lots, Lake Superior ingot, 12¾@13c.; electrolytic, 12.65@12.75c.; casting copper, 12.60@12.70c.

Pig Lead—Carload lots, 3.67½@3.70c., f. o. b. New York.

(*Quotations continued on page 40.*)

Great Saving in Use of Arbors, By using Greenerd Arbor Press.

Made by Edwin E. Bartlett, 374 Atlantic Ave., Boston, Mass.

(*Quotations continued from page 30.*)

Pig Tin—For 5 and 10 ton lots, 18c., f. o. b.
Spelter—In carload lots, 5¼c., New York delivery.
Antimony—In cask lots: Cookson's, 9½c.; Hallett's, Japanese and French E. B., 8¾c.; United States, 8.70 @ 8.75c.
Lard Oil—Prime city, present make 44@45c. for the leading brand in wholesale lots.

▲ ▲ ▲

Manufacturers.

A sawmill is being erected at Lake Temiscouta, Que., by James Miller, of St. John, and D. A. Huntley, of Parrsboro.

H. Sewrey, G. H. Sewrey and W. Johnson are building a foundry in Barrie, Ont. It will be a one story frame building, 120 feet long and 36 feet wide.

The General Electric Company has established a sales office in the Templeton Building, Salt Lake City, Utah. It is in charge of Mr. F. E. Chubbuck.

The Atlantic Company has been organized at Portland, Me., for the purpose of making and dealing in machines of all kinds and carrying on a general manufacturing business, with $500,000 capital stock.

It is announced that J. N. Stearns & Co. will erect a silk factory at Elmira, N. Y. The plant will be located on Reformatory avenue, and employ 800 hands.

Extensive improvements are being made at the Botany worsted mill, in Passaic City, N. J. A wing 100x94 feet will be added. The cost is estimated at $16,000.

A. C. Hager will build a four-story cold storage building, also a boiler and engine house, at Lake Odessa, Mich., at a cost of $15,000, for which the plans were made by the F. W. Wolf Company, architects, of Chicago.

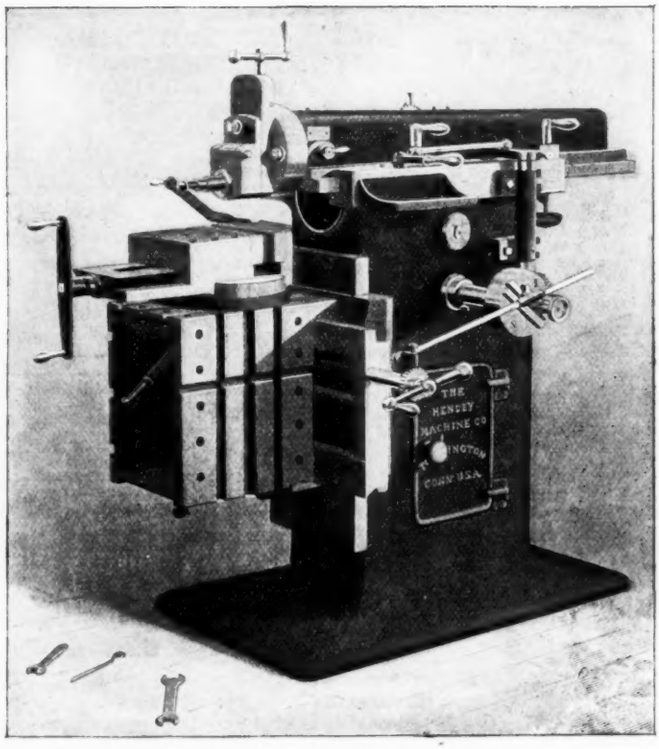
The Southern Engine & Boiler Works, Jackson, Tenn., is doubling the capacity of its foundry, and will put in about $5,000 in new tools and machinery.

Messrs. Lathbury & Spackman, engineers, of Philadelphia, Pa., have been engaged to remodel the Old London Portland Cement Company's plant, at Marlbank, Ont., Canada. The work consists in practically rebuilding the plant and substituting rotary kilns for the kilns formerly in use.

The Simplex Car Appliance Company, now at Hammond, Ill., expects soon to remove its plant to Whiting, Ind., where it will build a new and extensive factory. The factory will cover an area of 96x300 feet and is to be begun at once. It will be finished in four months and will give employment to over 100 men.

Articles of incorporation were filed recently in the Camden County clerk's office by the Sanitary Street Sweeping Company. The objects of the corporation are to manufacture, purchase and acquire street cleaning and sweeping machines. The capital stock of the company is $100,000; the amount paid in is $1,000. The incorporators are Charles D. Nicolai, Lawrence S. Nicolai, John Fitzmorris and John H. Buscher, all of Washington, D. C., and James E. Hays, of Camden, N. J.

It is stated that the Harrisburg (Pa.) Foundry & Machine Company contemplates the erection of a new plant from plans designed by Vice-President William R. Fleming. A tract of five acres of land has been purchased, and on one corner of this tract will be built a brick and steel building, 260 feet long by 140 feet wide. The foundry will be 90x100 feet and the machine shop 50x122 feet. A specially designed trolley car operated by the underground electric system will be used for transporting castings to and from the various departments. The new plant is estimated to cost about $200,000.



24 inch

Pillar Shaper.

These shapers have a positive locking friction, and are guaranteed to work accurately to a line.

Stroke quickly adjusted to any position with ram in motion. Then it can be varied in the smallest degree with our micrometer adjustment stop. Shapers have quick return, also two cutting speeds.

The

Hendey Machine Company,

TORRINGTON, CONN.

Agents for the Pacific Coast: Pacific Tool and Supply Company, San Francisco, Cal.
J. W. Cregar, Philadelphia Bourse Exhibition,

EUROPEAN AGENTS:
Schuchardt & Schutte, Berlin, Vienna, Brussels; Chas. Churchill & Co., Ltd., London and Birmingham, England; Adolphe Janssens, Paris, France.

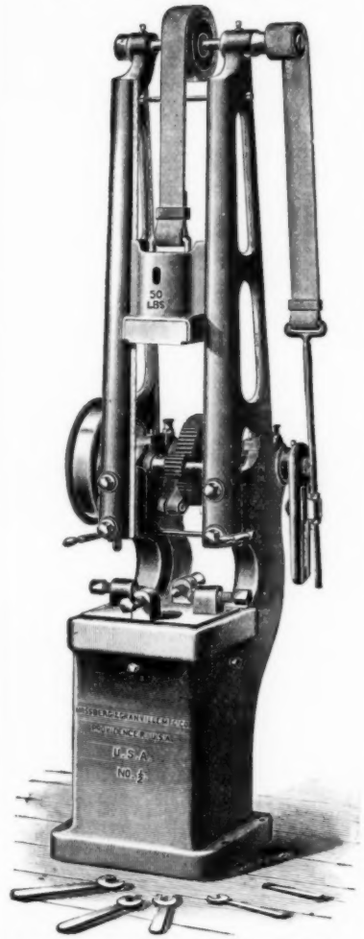
Before Buying
Punches or Shears

write for the Bethlehem book, describing and illustrating the best made.

Bethlehem Foundry & Machine Co.
So. Bethlehem, Pa.

THE E. S. STILES PRESS CO.
of Watertown, N. Y., carry a complete line of
PRESSES, DROP HAMMERS, SHEARS, Etc.,
in their New York store, 243 Centre street.
Telephone Call: 2351 Spring.

The——
Capacity of this Press is
15,000 to 20,000 Pieces of finished work per day of 10 hours.



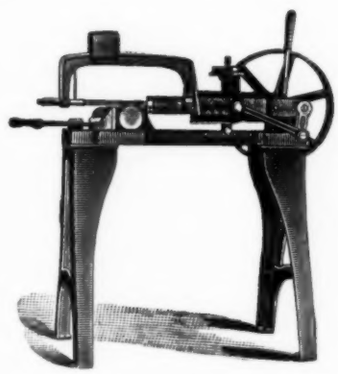
No. ½ Automatic Drop Press (patented).

Designed for such work as flattening, light bending, riveting and marking operations, at a saving of from 20 to 40 per cent. over old style drop presses.

Mossberg & Granville Mfg. Co.,
Providence, R. I., U. S. A.
Makers of Presses, Rolling Mills, Wire Drawing Machinery, Mossberg Roller Bearings and Special Machinery.

"The best is as good as any."

The New
Automatic and Gravity Feed
Q & C Shop Saw



Cuts Tool Steel, Machinery Steel, Iron, Brass and All Other Metals.

Price—'Way Down.
Quality—'Way up.

Shop Saws,
Portable Rail Saws,
Cold Power Saws,
For All Purposes.

Send for Catalogue.

Q & C Company,
Chicago. New York.

LONDON : Chas. Churchill & Co.
PARIS : Hounsfield & Fils.
BERLIN : Schuchardt & Schutte.
MADRID : J. G. Neville & Co.

New Catalogs.

There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9" x 12", 6" x 9" and 3½" x 6". We recommend the 6" x 9 size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

Brazie & Co., of Amsterdam, N. Y., have issued a catalog illustrating and describing their smokeless furnace and steam generator. Illustrations showing method of applying the attachment to boilers, accompanied by statement of its advantages, are given. A few testimonial letters are also given. The catalog is standard size, 6x9 inches.

The Wickes Brothers, Saginaw, Mich., have sent us catalog of the Wickes vertical water tube steam boilers. The catalog contains some interesting facts as to the generation of heat, water circulation, efficiency, etc., of these boilers. A number of illustrations are also included showing the construction of the boilers. The catalog is 7x10¼ inches.

We have received catalog "M" of the Marine Iron Works, Chicago, in which are described various types of marine engines of single, compound and triple construction. Other machinery for marine service, such as feed pumps, propellers, boilers (Scotch and water tube), are illustrated and described. The catalog is standard size, 6x9 inches.

We have received from the E. S. Stiles Press Company, Watertown, N. Y., Section A catalog of open back presses. The construction and method of operation of the clutch mechanism, as applied to these presses, are described in detail. The presses are made both upright and inclined, resting on iron pedestals, and are also adapted to bench work. The catalog is 4½x6¼ inches.

The Case Manufacturing Company, Columbus, Ohio, has sent us catalog of cranes operated by electricity, steam, belt and hand, with a number of half-tone illustrations, showing these cranes in service. There are also described locomotive cranes, and to those interested in the installation of hoisting machinery the catalog should prove of great interest. It is 7½x10¼ inches.

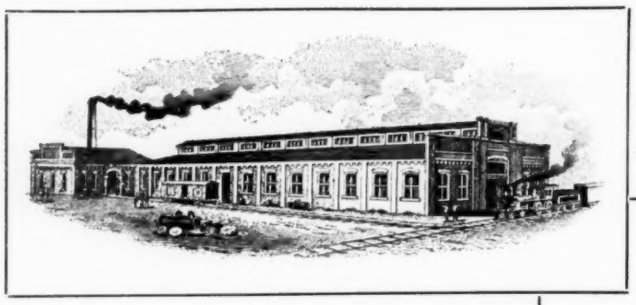
Macleod & Clark, of Cincinnati, Ohio, have issued catalog describing the Buckeye Portable Torch Light. Illustrations are given showing in what connections this light can be used, such as in laying tracks, excavating and dredging operations at night. Other specialties, including rivet heaters, asphalt heaters, paint spraying apparatus, etc., are described. The catalog is 5x7¼ inches.

Wells Brothers & Co., Greenfield, Mass., have issued catalog and price list of their universal grinder. Illustrations showing how a variety of tools, such as reamers, arbors, milling cutters, etc., are ground are given. The range of this grinder is somewhat extensive. Instructions for the operation of the machine in order to secure best results are given. The catalog is standard size, 6x9 inches.

The Whiting Foundry Equipment Company, Harvey, Ill., has issued a general catalog, in which is described and illustrated practically all kinds of appliances that tend to constitute a well appointed foundry. Cranes (hand power and pneumatic), cupolas, ladles of various styles, tumblers and the Avery molding machine are described and illustrated. The catalog is standard size, 6x9 inches.

The Connersville Blower Company, Connersville, Ind., have issued catalog No. 3, in which are described pressure blowers, rotary pumps, hydraulic motors, gas exhausters, etc. The catalog contains a number of interesting half-tones and sectional illustrations showing the construction of the machines described. For those interested in the selection and installation of blowing machinery the catalog contains some valuable suggestions. A number of testimonial letters from users are included, and the catalog is standard size, 6x9 inches.

OTT. MERGENTHALER & CO.,



Baltimore, Md.,
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Our Specialties.

MILLING MACHINES, ...
SPEED LATHES and SLIDE RESTS,
MILLING CUTTERS, ...
ADJUSTABLE REAMERS, . .
DESIGNING and BUILDING SPECIAL TOOLS, AUTOMATIC MACHINES, MODELS, ETC. . . . .
GEAR CUTTING. . . .

See Our Exhibit of Small Tools at the Philadelphia Bourse.

J. W. Cregar, Agent.

EUROPEAN AGENTS:

Selig, Sonnenthal & Co., London, England.
E. Sonnenthal, Jr., Berlin, Germany.

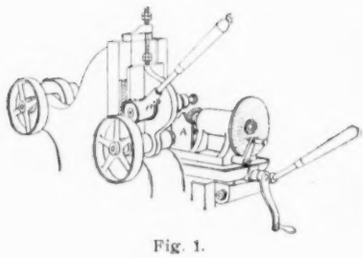


Fig. 1.

The Whitney Mfg. Co.,

HARTFORD, CONN., U. S. A.

New Universal Hand Milling Machine.

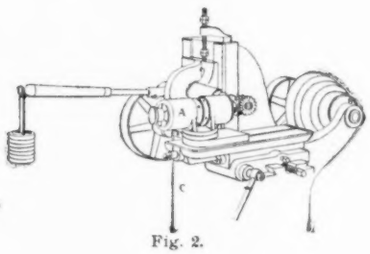
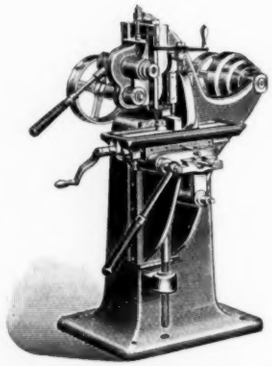


Fig. 2.

Figs. 1 and 3 show machine for profiling. Fig. 2, the machine slotting or slabbing cylindrical The rod C withdraws lock bolt, holder. The finished piece may serted while the piece on oppo- Fig. 4 shows machine as arranged seats for Woodruff Patent System attachment.



as used with former attachment with special indexing fixture for pieces, such as screws, valves, etc. allowing operator to revolve the be extracted and a new blank in- site end of holder is being milled. for cutting, automatically, key- of Keying by means of weight

FOREIGN AGENTS—Charles Churchill & Co., Ltd.
C. W. Burton, Griffiths & Co.
Gustav Diechmann & Sohn.
Fenwick Freres & Co.

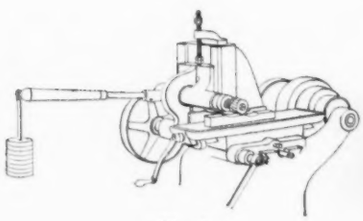


Fig. 3.

WOODRUFF PATENT SYSTEM OF KEYING.

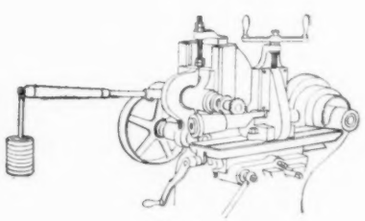


Fig. 4.

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16 in. Gould, crank.
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12 in. Warren, traveling head, crank.
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13 in. Putnam Slotter.
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2 No. 2 Putnam Bolt Cutters, fine.
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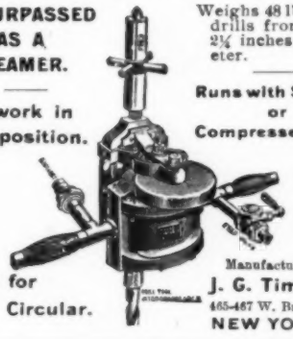

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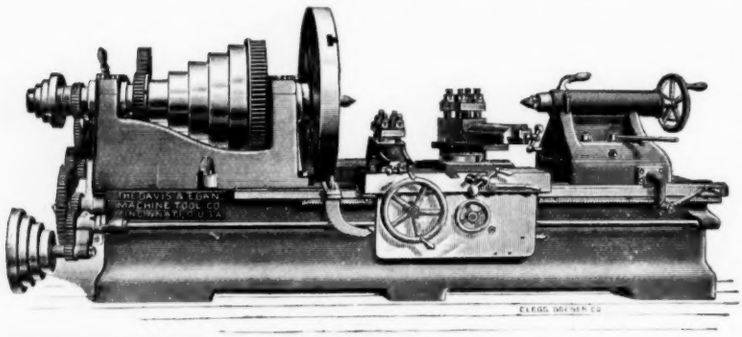

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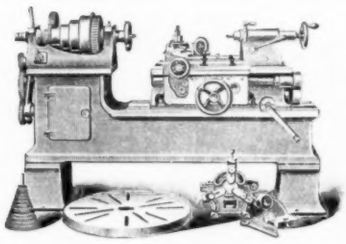

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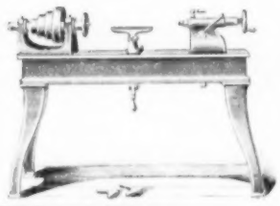

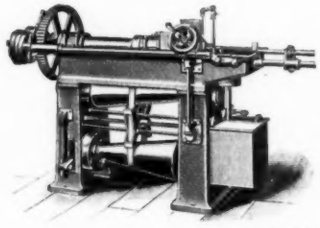

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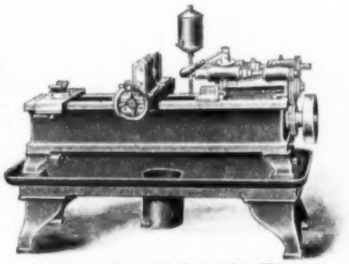

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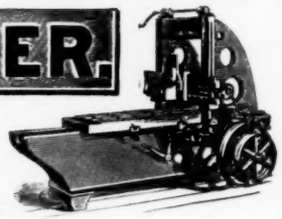

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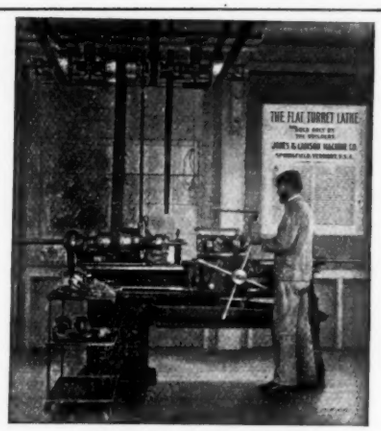

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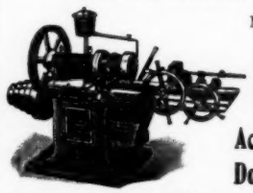

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